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FEDERAL-GRANT RESEARCH
at the
STATE AGRICULTURAL
EXPERIMENT STATIONS

Projects in

SOILS

Part 21, Section b

Soil Fertility, Management and
Soil-Plant Relationships

Agricultural Research Service
UNITED STATES DEPARTMENT OF AGRICULTURE

Compiled April 1958 by

The State Experiment Stations Division, Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C., for use of workers in agricultural research in the subject-matter areas presented. For information on specific research projects write to the Director of the Station where the research is being conducted.

Issued June 1958

FEDERAL-GRANT RESEARCH

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Section b: Soil Fertility, Management and Soil Plant Relationships

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INTRODUCTION

This compilation is one of a series providing information on State agricultural experiment station research supported by Federal-grant funds appropriated annually by Congress under authorization of the Hatch Act of 1887, as amended and approved Aug. 11, 1955, and Section 204(b) of the Agricultural Marketing Act of 1946. It is prepared for use by research workers in the subject-matter areas presented. Only that part of each State's research program supported by Federal-grant moneys is included.

In addition to the Federal-grant moneys, the State experiment stations receive some Federal support through cooperative agreements or contracts with the U. S. Department of Agriculture. Information on such research, along with other departmental research, is available in the Central Project Office, Agricultural Research Service.

A substantial part of each State agricultural experiment station's research is supported with moneys appropriated by the respective State or Territorial Legislatures and through other forms of private and public financing. Information on current agricultural research at the stations which is not financed under the Federal-grant program or through USDA cooperation can be obtained from experiment station directors.

The information given in the series of Federal-grant compilations includes the title and objectives of each Federal-grant project pertaining to the subject given on the cover. The identification of each project gives the department(s) conducting the research, the station number of the project, and the number of the regional project if it is a contributing project.

Relevant regional projects, if any, appear at the end of the compilation. States having projects contributing to regional projects are indicated. The Roman numeral (and capital letter) refer to the location in the summary of the contributing project title and objectives. The States are grouped into four major regions. These are designated NC-North Central, NE-Northeastern, S-Southern, and W-Western. The capital letter "M" following the letters for the region indicates regional marketing projects.

I. FERTILITY AND FERTILIZERS

A. Fertility Levels and Maintenance

Ariz. Fertility Requirements of Crops on Alkaline-Calcareous Soils of Different Types, Under Semi-Arid and Irrigated Conditions. (1) Learn nature & extent of crop response to added nutrients on soils of different characteristics; (2) evaluate nutrient interactions & levels of responsiveness; (3) learn efficiency of different fertilizers with varying characteristics; (4) evaluate effect of time & method of application; (5) study effect of fertilizer on growth characteristics of plants & quality of product; (6) relate crop response to nutrients, especially P, to existing & new methods of soil testing; and (7) relate crop composition & tissue test to nutrient response & soil test volume.
Agr. Chem. 266

Calif. The Determination of the Fertilizer Requirements of California Soils as Indicated by Pot & Field Trials, with the Aid of Laboratory Studies. To determine kind, amount, time of application, and placement of fertilizer.
Plant Nutr., Soils 1157

Calif. Brush Seedling Establishment and Growth in Relation to Soil Fertility Levels. To determine (1) if brush increase is related to soil fertility level; and (2) to what extent brush can be controlled by increasing soil fertility thru fertilization.
For., Agron., Soils 1570 (W-25) Coop. SCS

Colo. A Study of Methods of Restoring the Productive Capacity of Land After the Surface Soil has been Removed by Land Leveling Operations or Erosion. To determine (1) basic causes of low crop yields on exposed subsoils; & (2) efficient & economical methods of restoring the crop producing capacity of land after removal of the topsoil.
Agron. 12

Del. Soil Fertility in Greenhouse Soil Mixtures. To (1) evaluate the fertility of various soil mixtures for greenhouse flower production; (2) find a practical method for maintaining greenhouse soils at optimum fertility levels; (3) simplify soil testing procedures for greenhouse soils & correlate them with crop responses; & (4) study the nutrient requirements of various greenhouse crops on a synthetic soil mixture.
Hort. 54-H

Hawaii

Investigations of the Nutritional Requirements of Crop Plants in Hawaii to Provide Information Which will Serve as a Guide to Scientific Fertilization. To accumulate information by means of physiological investigation on the nutrition of crop plants in Hawaii. This knowledge is to be used as a guide in future recommendations for fertilizer treatments to maintain optimum yield & quality of crops.
Plant Physiol. 659

Hawaii

Nutritional Requirements of Coffee Growing on Lava Rockland Soil. Learn (1) phosphate requirements of coffee grown in rockland areas; (2) if there are any minor element requirements for high yields in rockland areas; & (3) importance of frequency of fertilizer applications, timing, & kind of carriers in promoting high yield in rockland areas.
Plant Physiol. 659.1

Ill.

Nitrogen, Phosphorus and Potassium Requirements of Vegetable Crops. To (1) establish correlations between response of vegetable crops to N, and P, and potassium fertilizers and soil tests for these elements usable as a basis of fertilizer recommendations; and (2) investigate physiological and morphological bases for variations in fertility requirements of vegetable crops.
Hort. 65-344

Iowa

The Need for and Efficient Use of Fertilizers on Different Soils. To (1) determine need for fertilizers on principal Iowa soil types; (2) study interaction of various fertilizer elements; (3) investigate needs of minor elements; (4) improve and develop soil tests for determining fertilizer needs; (5) determine time and rate of application and method of placement of fertilizer by various crops; (6) study residual effects of various fertilizers; and (7) compare effectiveness of various phosphate fertilizers.
Agron. 1189 Coop. TVA

Mo.

Soil Treatments for Maximum Crop Yields. To determine maximum addition of different nutrient elements to provide optimum yields and crop production efficieny.
Soils 230

Mont.

Improvement of Soil Fertility for Sugar Beet Production Through Organic Matter and Fertilizer Treatments. To determine (1) value of organic matter in improving soil fertility for sugar beets thru comparisons with commercial nitrogen fertilizer; (2) comparative value of green manure, barnyard manure, and N fertilizer in improving soil fertility for sugar beet production; and (3) relative value of sweet clover and alfalfa as green manure crops under different systems of irrigation.
Agron. 149 MS 944

Nebr. Mineral Element Status of Nebraska Soils in Relation to Crop Production. To (1) determine status of potassium in important soils of Nebraska and relationship between potassium levels in soils and the response of crops to potassium fertilizer; and (2) study effects of different levels of potassium, phosphorus, sulfur and other mineral nutrient elements on composition of grain and forage crops.
Agron. 476 Coop. ARS

Nev. Fertility Status of Nevada Soils, and Their Needs for Fertilizers or Other Items of Treatment or Management, for the Improvement of Yields and Quality Crops. To obtain information on which to base recommendations on use of fertilizers, soil amendments, and other items of soil management, to farmers operating on major soil types in the farming areas of the state, with a subobjective--to correlate rapid chemical tests with crop responses to soil treatments.
Soils, Plant Nutr. 66

N. C. Soil Fertility in Relation to Soybean Growth and Production. To (1) determine relative importance and contributions of native soil fertility, other properties of entire root zone, and supplementary plant nutrients to growth and fruiting of soybeans; and (2) study relationships between soil and environmental conditions and crop in soybean growing areas of North Carolina with special reference to factors which are limiting yields.
Soils 118

N. C. A Study of the Nutritional Status, Requirements, and Methods of Correcting Deficiencies of Blueberry and Strawberry Plantings in North Carolina. (1) Learn optimum nutrient-element contents of leaves of blueberry & strawberry plants in State; (2) compare these standards with leaf nutrient-element contents of State strawberry & blueberry plantings; & (3) obtain basic nutritional status data to guide development of additional nutritional research.
Hort., Soils H-152

N. C. The Effect of Established Soil Nutrient Levels and Fertilizer--Applied Nutrients on the Growth and Quality of Vegetable Crops and on the Chemical Properties of the Soil. Study (1) procedures which will lead to the establishment & maintenance of soil nutrient levels for optimum growth & yield of vegetable crops; (2) feasibility of succession cropping with two or more high-value vegetable crops during the same year; (3) relation between soil nutrient levels & plant composition thru soil and plant analysis; (4) possible relationship between mineral nutrition and quality of vegetables; and (5) establish a basis for future experiments which will lend themselves to economic interpretations.
Soils, Hort. H-154

Pa. The Nutrient Requirements of Floricultural Crops. Learn (1) the balance between & degree of saturation of various nutrient elements & their effects on yield & quality; (2) critical values for nutrient elements where deficient symptoms occur; (3) establish liquid fertilization programs; and (4) learn relationship between rapid soil tests & fertilization programs.
Hort. 1313-B

P.R. Nutrient Requirements of the Principal Economic Crops of Puerto Rico. To determine the initial available concentrations of the principal plant nutrients for optimum growth of the principal economic crops.
Soils 22

Wash. Soil Fertility Investigations. To (1) evaluate ability of soils in Eastern Washington to supply under high levels of productivity the nutrient elements not now considered limiting; (2) determine and evaluate role of the climatic, soil, and plant characteristics affecting interpretation and extrapolation of results of field fertilizer trials and (3) determine effects of method, time and rate of application of fertilizer materials on yield and quality of the crops for which this information is not now available.
Agron. 1142

B. Nitrogen

Ala. Nitrogen Economy in Different Systems of Crop and Soil Management. To (1) learn response to N fertilization of row crops and small grains under various management practices; (2) study effect of rates, placement, & time of application of N on establishment & maintenance of grasses, legumes, etc.; (3) measure rate of movement and oxidation of N in solum under different temperature and moisture conditions; (4) evaluate effects on soil properties of long time experiments using different sources and rates of N; and (5) learn efficiency of several sources of N applied to surface of high lime soils.
Agron., Soils 402

Alaska Anhydrous Ammonia for Alaska's Agriculture. To study response of Alaska's economic crop plants to anhydrous ammonia as a carrier of fertilizer N.
Soils, Engin., Agron. 3

Ark. Corn Fertilizer and Spacing Experiments. To (1) determine effects of 5 N levels and 3 spacings on yields of hybrid corns; and (2) study effect of above factors on ear size, number of ears per stalk, and on root and stalk lodging of two hybrids; a late-maturing prolific and an early, non-prolific hybrid.
Agron. 363

Colo. The Effect of Fertilizers on the Seasonal Trends in Nutrients of Native and Reseeded Forage Plants in Relation to Range Livestock Production. To determine effect of N fertilization on production and nutrient content of native range and reseeded pastures.
For., Range Mgt. 62

Colo. Factors Influencing the Availability of Nitrogen in Soils. To learn (1) effects of moisture tension and amount and kind of organic matter on biological immobilization, and mineralization of N; (2) influence of rate, source, time of application, and placement of N carriers on changes which fertilizer N undergoes in soil, and changes in soil properties; and (3) mineralization of organic N as an aid in estimating fertilizer requirements.
Agron. 226 (W-31)

Ga. Rates of Nitrogen Fertilization for Corn with Different Levels of Plant Populations With and Without Irrigation. To learn effect of ample supply of water onthe inter-relationship between N and plant population on corn grown under different environmental conditions and their effects on yield and nutritive value.
Agron. 45

Hawaii A Study of the Fundamental Factors Affecting the Behavior of Nitrogen in Hawaiian Soils. (1) Learn degree of ammonium fixation & soil minerals responsible for such fixation; (2) study rates of leaching, volatilization, & nitrification of added N carriers; evaluate role played by soil minerals in governing N behavior; (3) study soils dominated by: primary minerals, montmorillonitic & kaolonitic minerals, & free oxides; & (4) conduct leachability test by using ammonium sulfate, ammonium phosphate, aqua ammonia, & urea in different soils.
Agron., Soil Sci. 134 (W-31)

Ill. The Nitrogen Reactions in Soils and Their Influence on the Effectiveness of Different Nitrogen Fertilizers. To determine (1) effectiveness of several forms of N when applied at different lengths of time before planting; (2) amount of NH_4^+ fixation by soils and study the factors affecting this reaction; (3) magnitude of N lost as N_2, NH_4 and NO_3 and investigate factors affecting such losses; and (4) effects of added N on amount and lasting qualities of soil organic matter.
Agron. 15-390

La. Utilizing Certain Properties of Agricultural Chemicals to Increase Yields of Sugarcane, or Sugar, Per Acre. Learn if sugarcane tonnage or sugar per acre yields can be increased thru use of properties of Urea-form & gibberellic acid.
Sugarcane 681

Maine

Nutritive Evaluation of Timothy Hay Grown with Various Levels of Nitrogen Fertilization. Learn (1) digestible energy & digestible protein content of first cutting timothy hay grown under various levels of N fertilization & harvested at full-head stage; (2) total protein, ether extract, ash & fiber content of these same hays; (3) lignin & cellulose content of these hays & study relation between these values & digestible energy values; and (4) apparent digestibility of crude fiber fraction of hays. Use 0, 50, 100, & 200# of N per acre.

Agr. Chem., Anim. Indus., Agron. 114 (NE-24)

Minn.

Soil Fertility Investigations: Soil Nitrogen. (1) Evaluate different N fertilizers; (2) learn optimum rates, placement & time of application of N fertilizers; (3) study migration rates of different forms of N thru soils utilizing N^{15}; (4) learn value of commercial N on utilization of crop residues & its relative value in comparison to N fixed by legumes; and (5) study soil-plant-N relations to learn mechanics of N uptake by plants.

Soils 2521

Miss.

Pasture and Forage Production Investigations. a. Evaluation of Coastal Bermuda-Grass: Methods of Establishment, Legume Associations, and Response to Fertilization and Irrigation. To (1) study methods of establishing Coastal Bermuda-grass in established sod without complete seed-bed preparation, and on well-prepared seed-bed; (2) determine most effective rate of N for production of Coastal Bermuda-grass hay and pasturage; (3) determine compatability of several Coastal Bermuda-grass-legume combinations; and (4) determine production potential of Coastal Bermuda-grass under irrigation with high rates of N.

Agron. HC-10

Miss.

Anhydrous Ammonia as Sources of Nitrogen for Crop Production. To determine (1) relative crop producing value of anhydrous ammonia compared to ammonium nitrate; (2) relation of soil properties to nitrification and retention of ammonia; (3) differential absorption of ammonia and nitrate nitrogen; (4) calibration of ammonia metering equipment for different application rates; (5) pressure exerted by anhydrous ammonia in tanks; and (6) formation of hydrogen cyanide by propane or butane contaminated with ammonia.

Agron., Soils HD-1

Miss.

Studies of the Effects of Nitrogen, Plant Spacing, High Humidity, & Day Lengths upon Pod Set & Yields of Southern Peas. To learn (1) best N level and plant spacing combination for high yield of southern peas, (2) effect of high humidity upon pod set of peas, & (3) day length best suited to pod set.

Hort. HK-17

Miss. Fall Versus Spring Application of Nitrogen for Summer-Growing Crops. To investigate influence of time of application of N on crop response to its use and to learn factors affecting efficiency of N applied at different times.
Agron. HU-3

Mo. The Improvement of Soil Fertility Through Heavy Applications of Nitrogen and Carbonaceous Organic Matter. To determine the possibilities for increasing soil organic matter and deepening soils thru addition of carbonaceous crop residues and chemical nitrogen.
Soils 231

Mo. Efficient Utilization of Soil and Fertilizer Nitrogen. To study (1) effect of rate & time of application on the efficiency of applied N; (2) efficiency of ammonia nitrogen as compared to nitrate nitrogen; and (3) effect of local weather on the over-all efficiency of N treatments for corn.
Soils 304 (NC-16)

Mont. The Influence of Nitrogen Fertilizer on the Yield and Quality of Established Bluegrass Pasture. Learn influence of rate of N fertilizer & time of fertilizer application on yield & quality of established bluegrass pasture. Apply each rate: biennially in April to measure carry-over or residual effect; annually at beginning of season or 1st of April; 1/2 in April & 1/2 in July following 3rd clipping.
Agron. 979 Coop. ARS

Nebr. Nitrogen Status of Nebraska Soils in Relation to Crop Production. To (1) evaluate soil and plant tests for determining N status of Nebraska soils in order to improve recommendations for N fertilizer; and (2) determine influence of soil N and application of N fertilizer on composition of grains and forage with emphasis on forms of N in plants.
Agron. 472 (NC-16) Coop. ARS

Nebr. Fertilizer Nitrogen Efficiency in Relation to Type of Carrier and Time of Application. Compare use of fall & spring applied ammonium & nitrate nitrogen by grain crops under field conditions.
Agron. 560 (NC-16)

N. Mex.

Retention and Effect on Soil Properties of Fertilizer Nitrogen in Calcareous Soils. To (1) learn extent of mineralogical and biological immobilization of N from fertilizers as influenced by organic matter content, soil type and level of P; (2) evaluate effects of N fertilizers on chemical and physical aspects of soil, and effect of organic matter and soil moisture level on losses in gaseous forms of applied N; and (3) learn leaching effect of movement in soil of N from various sources.
Agron. 48 (W-31)

N. J.

Relation Between Nitrogen Level, Pruning, Sanding and Crop Production of Cranberries. Learn (1) optimum N requirement in relation to 3 degrees of pruning; (2) coordination of N level & pruning with use of picking machines; & (3) evaluate cultural procedure in sanding vs pruning.
Hort., Soils 367

N. C.

Soil-Plant Investigations Using Stable Isotopic Nitrogen. To (1) make fundamental studies of behavior of nitrogen in the soil; and (2) study utilization by plants of nitrogen from different sources.
Agron., Soils 106

N. Dak.

Effect of Time of Application and Form of Nitrogen Fertilizer on Crop Response. (1) learn influence of date of application on efficiency of various forms of N when applied to various North Dakota soils; and (2) develop a laboratory soil test which will aid in prediction of yield responses of crops to N fertilization. Apply ammonia or ammonia-producing and nitrate fertilizers to non-fallow land at 2 dates in fall and prior to seeding in spring.
Agron., Soils 15-7 (NC-16)

Ohio

Nitrogen and Mineral Nutrition of Tree Fruits. To (1) learn influence of differential nitrogen fertilization on the absorption & accumulation of mineral elements & on the growth, yield, & fruit quality of mature bearing apple trees; (2) learn influence of different rates & combinations of N, P, & K fertilizers on the growth, chemical composition, & productivity of newly established apple orchards; (3) learn effect of soil & spray applications of K & Mg on growth, chemical composition, & productivity of a young orchard established on site previously shown to produce foliage containing less than established critical levels for these elements; & (4) attempt to further refine nutritional needs of tree fruits with respect to macro & micro-nutrient elements by means of foliar analysis & correlation with growth, yield, & quality of the fresh product.
Hort. 69

Ohio

Efficiency of Fall and Spring Applied Nitrogen for Corn. Learn efficiency of fall & spring applied nitrate nitrogen & ammonia nitrogen as sources of N for corn.
Agron. 169 (NC-16)

R. I.

Availability of Surface Applications of Natural and Synthetic Nitrogen Compounds for Fine Turf. Compare nitrification rates of slow decomposing natural & synthetic N sources applied on surface & mixed in soil. Select best single source of mixture of materials to extend effects of a single fertilization thru summer season. Use as N sources; castor pomace, activated sewage sludge, processed tankage & urea-formaldehyde resins, with stress on latter.
Chem., Agron. 3

R. I.

Comparison of Nitrogen Fertilizers for Grass and Grass-Legume Forage Mixtures. Learn (1) value of several N carriers applied to grasses & grass-legume mixtures for forage production; (2) effect of N fertilizer applications on botanical composition of grass-legume mixtures; (3) measure N recovery in treated forage; & (4) compare weight gains of dairy heifers on N-fertilizer pasture mixtures.
Agron., Agr. Chem. 216

S. C.

Use of Nitrogen Fertilizer Materials for Efficient Crop Production. To learn (1) most efficient rate of application of N for selected crops on some important soil types using ammoniated superphosphate as source of N under the crop with varying sources (including urea, NH_4NO_3, anhydrous ammonia, N solutions, and others) for top and side dressing; (2) most efficient time to apply some sources of N, chiefly urea, NH_4NO_3, and anhydrous ammonia to small grains and pasture grasses; (3) crop response from complete fertilizers in solution (NPK) as compared with standard forms; (4) residual effects of various sources of N on soil reaction and other properties; (5) effect of large amounts of plant residue left on soil on N needs of succeeding crops; and (6) effect of varying rates of N applications on ratio of N, P_2O_5, and K_2O used by selected crops.
Agron. 85

Tenn.

Nitrogen Fertilization of Farm Crops. Learn influence of (1) form & rate of N on yield, quality, & chemical composition of farm crops; (2) levels of other nutrient association on crop response to N;& (3) temperature, moisture, placement, & time of application on crop response to N. Study placement of N & the time of application with several crops at different locations. Make lab. & field studies on tolerance of seedlings. Measure influence of several soil properties on relative response of a given increment of N. Study P & K fertility levels, soil moisture level, Ca or pH level, soil temperature, & placement associated with other nutrients as P & K.
Agron. 164

Utah

The Transformation, Losses, and Efficiency of Utilization of Nitrogen in Soils in Relation to Moisture. Learn (1) influence of moisture tension on uptake of N by higher plants from soils of various properties under controlled conditions; and (2) influence of moisture tension and related factors on N transformations in soils and N losses from soils under controlled conditions.

Soils 456 (W-31) Coop. ARS

Vt.

Effect of Fertilizer Nitrogen on Availability and Uptake of Plant Nutrients. (1) learn effect of different rates, forms, & modes of application of N, on plant uptake & availability of soil K, P, Ca, & Mg.; & (2) study influence of N fertilizers on legumes in relation to establishment, nodulation, N, & mineral content of legume plants.

Agron. 67

Wash.

The Extent and Significance of Ammonium Fixation by Soil Minerals. Survey ammonium fixing capacities of soil, identify minerals or other soil constituents which may be responsible for fixation of ammonium by soils, evaluate factors associated with conditions of ammonium addition which determine ammonium fixing capacities of soils under field conditions, develop way for learning degree to which ammonium fixing capacity of field soils has been satisfied and evaluate significance of ammonium fixation by soil minerals to crop production and soil management.

Agron. 1253 (W-31)

W. Va.

Using Nitrogen Fertilizer Efficiently. To (1) determine effect of time and rate of application of various N fertilizers on the yield, quality, and economic production of grain and forage crops; (2) evaluate tests of N availability and relate these to response to N fertilizers under various conditions; and (3) evaluate effect of N fertilizers on the physical, chemical, and biological properties of the soil.

Agron., Genet. 82

Wis.

Efficiency of Various Forms of Nitrogen When Fall and Spring Applied. Evaluate efficiency of fall vs. spring applied nitrogen when applied as ammoniacal, nitrate, & urea nitrogen. Preceding crop - non-legume; test crop - corn.

Soils 1010 (NC-16) Coop. ARS

Wyo.

The Effect of Nitrogen Fertilizers on the Physical Conditions of the Soil. Study effect of (1) various N fertilizers on physical conditions of the soil; and (2) of anhydrous ammonia on soil physical properties as modified by other soil factors. Prior to planting or immediately after emergence, apply nitrogen at rates of 0, 160, 320# per acre. Grow corn and sugar beets in rotation.

Agron., Agr. Res. Chem. 631 (W-31)

(For more information on research in this category, see Section a, II, A. Nitrogen Fixation and Transformation.)

C. Phosphorus

Ala. Factors Affecting the Nature and Behavior of Native and Added Phosphates in Soils. To (1) determine importance and mechanism of P fixation in various soils; (2) study residual value of applied P for plant growth; (3) determine movement and losses of P applied to soils; (4) study value of various sources of P for plant growth; and (5) review, summarize, and interpret P data obtained.
Agron., Soils 306 Coop. TVA, ARS

Ariz. The Availability of Native Soil Phosphate and New Commercial Phosphate Fertilizers in Arizona Calcareous Soils. To study (1) availability of native soil phosphate as influenced by application of barnyard manure, incorporation of various crop residues;and (2) adaptability of certain new commercial phosphate fertilizers to Arizona soils.
Agr. Chem., Soils 280

Ark. Factors Affecting the Uptake of Phosphorus From Rock and Superphosphate. To (1) evaluate effect of long-time fertilization with rock and with superphosphate on efficiency of uptake of P by crops from current applications of superphosphate; (2) determine effect of above past treatments on available phosphorus per acre; (3) correlate available P so determined with soil tests for available P; (4) measure bonding energy of Ca to root systems of test crops used as a possible explanation for uptake of P from rock phosphate; (5) compare in the field efficiency of rock phosphate, superphosphate, and combinations for oats and corn, grown with and without a green manure crop, and for annual, biennial and perennial legumes and grass; and (6) study in the greenhouse the effect of green manuring on P availability from insoluble phosphates.
Agron. 368

Colo. The Behavior of Natural and Artificial Phosphates in Calcareous and Alkali Soils, Including: Solubility, Chemical Activity and Availability to Plants. To (1) develop satisfactory methods of evaluating phosphate fertility status of calcareous and alkali soils; (2) determine comparative efficiency of different phosphate fertilizer methods for different crops under different systems of application, and (3) contribute to basic knowledge of nature of native and applied phosphate materials and their utilization by crops in calcareous and alkali soils.
Agron. 127 Coop. TVA

Ga. Influence of Certain Plant Nutrients on Yield and Quality of Corn. To determine the influence of newer forms on phosphates in varying quantities and in combination with lime and other plant nutrients on the yield and quality of corn in the Tennessee Valley watershed area of the mountainous section of north Georgia.
Agron. 35

Iowa Soil and Fertilizer Phosphorus and Their Availability to Plants. To (1) investigate nature and behavior of inorganic and organic phosphorus in soils; (2) determine availability to plants of P in various soils and relate differences in availability to nature and behavior of soil P; (3) investigate behavior in soils of P added in various fertilizers; (4) relate nature and behavior of added P fertilizers to availability of P to plants; (5) investigate soil-plant relationships in P nutrition of plants; and (6) modify and develop methods as needed for the investigations.
Agron., Soils, Climatol. 1183 (NC-16) Coop. TVA

Kans. Organic Phosphorus Release in Soils as Related to Microbial Activity. Learn (1) importance of soil microorganisms in release of P from soil organic matter; (2) factors influencing rate of P release, as effect of added N in form of ammonia, or nitrates, or addition of various organic amendments as crop residues; and (3) relate findings to fertilizer testing, and recommendations as to fertilizer use and agronomic management of Kansas soils.
Bact. 500

Mass. Soil-Fertilizer Phosphorus: Mechanism of Fixation and Release and the Role of Supplementary Materials in Increasing the Efficiency of Phosphate Utilization. To (1) compare different phosphate materials as sources of phosphorus for crops; (2) study further chemistry of fixation and solubilization of a. insoluble or fixed soil phosphorus; b. applied soluble phosphates, and c. applied insoluble phosphates; and (3) improve and develop methods for increasing the availability of applied and soil phosphorus for use by plants.
Agron. 10

Minn. Radioisotopic Investigations on Soils and Crops. To determine by field and greenhouse studies with P^{32} the immediate and residual use of different nutrients by various crops.
Soils, Engin., Agron. 2511 Coop. AEC, ARS

Mont.

Mechanisms Which Effect the Immobilization of Phosphorus in Montana Soils. To (1) measure on selected soils processes which have been shown to mobilize and make phosphates unavailable to plants; and (2) determine movement and penetration of phosphates in selected Montana soils.
Chem. MS 901

Nebr.

The Effect of Rock Phosphate and Superphosphate upon The Yield, Longevity of Stand, and Phosphorus Content of Alfalfa Grown on Sandy Soils of Northeastern Nebraska. To study (1) comparative results from use of rock phosphate & superphosphate; (2) use of combinations of these for alfalfa; (3) use of P fertilizer at planting time of alfalfa supplemented with annual application of P fertilizer to soil surface; & (4) influence of lime upon availability of rock phosphate to alfalfa.
Agron. 332-A (NC-16)

N.Y.
(Cornell)

An Investigation of Methods for Improving the Quality and Economy of Production of Feed Crops in the Principal Soil and Climatic Regions of New York State. IV. The Relation of Phosphorus to the Nutritional Quality of Forage Crops. To obtain more adequate information on the secondary effects of soil phosphorus on plant composition, apart from total yield; and to study root and aerial environments as an aid in predicting what can be expected on a given soil in different seasons.
Agron. 46 IV Coop. ARS

Ohio

Lime Phosphate Studies. 2. Factors Affecting The Availability of Phosphate Fertilizer and Native Soil Phosphorus Compounds. To study (1) availability of phosphates, both native and applied, especially fertilizer phosphates which have been fixed in soil absorption complex; (2) availability of organic phosphates, especially to soybeans; and (3) interrelationship between phosphates and silica in soil.
Agron. 9-2

P. R.

The Role of Phosphorus in Tropical Crop Production. To determine (1) what part of the phosphorus fertilizer added to a soil is taken by the crop, and what part is fixed by soil; (2) rate of leaching of available phosphorus in tropical soils under lab conditions; and (3) rate of penetration of available phosphorus under field conditions.
Soils 19 Coop. USDA, Oak Ridge Inst. of Nuclear Studies

P. R. Correlation of Available Phosphorus of the Olsen Method with Crop Yields in Puerto Rico. (1) Learn the available P contents in soils of Puerto Rico by the Olsen method; (2) correlate yield responses of crops to P added to soils with available P determined as above; and (3) learn surface P in those soils that show a high rate of P fixing power which prevents attainment of objective (2).
Soils 105

S. C. Relation of Ion Exchange Properties of Soil and Application of Nutrients to Yields and Chemical Composition of Forage Crops. To (1) study residual effect of phosphate application to an Orangeburg fine sandy loam soil under limed and unlimed conditions on yields and chemical composition of forage crops; (2) determine effects of amounts of different exchangeable ions on yields and chemical composition of crops; (3) determine influence of different fertilizer ratios on nutrients in soil and their availability; (4) determine relative utilization of applied and native phosphorus; and (5) determine use of phosphorus as affected by frequency of applications.
Agron. 26

Tenn. Nutrient Phosphorus Value of Rock Phosphate to Various Plants and Under Various Soil Treatments Such as Organic Matter. To learn effect of incorporations of organic matter and manure on availability of P_2O_5 from rock phosphate as indicated by response of legumes and non-legumes, by P_2O_5 content of several crops and by P_2O_5 and F uptake by different crops.
Agron. 36

Tenn. The Comparative Value and Relative Efficiency of Various Phosphate Fertilizers Under Different Soil and Cropping Conditions. To (1) compare relative efficiency of fused tricalcium phosphate and dicalcium "nitraphosphate" of different particle sizes, concentrated superphosphate, ordinary superphosphate and rock phosphate on certain crops; and (2) study residual effect of various phosphates on succeeding crops.
Agron. 38 Coop. TVA

Va. Influence of Soil Properties on the Value of Rock Phosphate and Superphosphate as Soil Amendments. (1) learn relative value of rock phosphate, superphosphate, and combinations of rock and superphosphate as fertilizer for field crops; (2) relate length of contact period of rock phosphate with soil to availability of P for plants; and (3) learn influence of soil type, total and available soil P, soil reaction and exchangeable cations on relative fertilizer values of rock phosphate and superphosphate.
Agron. 86026

D. Potassium

Ala.

The Behavior of Potassium in Soils. To (1) determine optimum level of K for major crops grown on various soils with emphasis on pasture and other forage plants and response to K additions on soils deficient in native available K; (2) determine relation between chemical, physical and mineralogical characteristics of soils and availability of soil K to plants; (3) obtain further data on effect of culture and soil amendments on K status of soils as to efficiency with which K is used in plant nutrition; and (4) learn effect of placement and application time of K fertilizer on crop response.

Agron., Soils 403

Ill.

Potassium Availability in Soils. To learn (1) procedures for relating "plant-available potassium" and "yield response to potassium fertilization" as basis for improving accuracy of predicting need for K fertilization; (2) influence of moisture level in soil, K fixation, relative amounts of K present in non-exchangeable, and water-soluble forms both in surface and subsurface soil layers on availability of K to plants; (3) residual effect of K fertilizer applications in relation to rate of application in a variety of soils; and (4) relation of K uptake by plants to available K in soil and fertilizer application.

Agron. 15-397 (NC-16)

Iowa

The Nature and Behavior of Potassium in Soils. To determine (1) K supplying power of soils in relation to a. amounts, forms, and profile distribution of K in Iowa soils, b. physiological factors such as aeration, ion competition, etc.; (2) mechanism, significance and interrelationships of K and ammonium fixation and release in soils; and (3) evaluation and improvement of methods for measuring availability of soil K to plants.

Agron. 1234 (NC-16) Coop. TVA

Kans.

Investigation of Amount of Exchangeable Potassium in Eastern Kansas Soils. To (1) determine amount of exchangeable potassium in representative Eastern Kansas soils; (2) correlate this index with plant analyses and yield data to evaluate significance of soil analysis; and (3) determine more precisely where soil supply of exchangeable potassium is a limiting factor in crop production either alone or in combination with other nutrient elements.

Agron. 394 (NC-16)

Mich.

A Study of Potassium Availability in Michigan Soils. (1) Study procedures for relating plant available K and yield response to K fertilization as basis for improving accuracy of predicting need for added potash fertilizer; (2) study influence of various factors on availability of K to plants, including soil moisture level, fixation capacity of soils, and relative amounts of K in various forms in surface and subsoil layers; and (3) learn residual effect of K fertilizer applications in relation to rate of application on different soils.

Soils 275-3 (NC-16)

Minn.

Factors Influencing the Release of Potassium from Genetically Different Minnesota Soils. To (1) study chemical, mineralogical and biological aspects of potassium release from genetically different soils of Minnesota; and (2) cooperate in a regional study on evaluation of potassium availability in soils and prediction of response to potassium fertilization.

Soils 2514 (NC-16)

Miss.

Potassium Status of Several Mississippi Soils as Affected by Clay Minerals. (1) Learn mineralogical composition of several representative soils of Mississippi; (2) combine mineralogical & cropping data to learn moderately available K & to evaluate the long-term K supplying power of the soil; & (3) learn which mineral component/s cause the increase in exchangeable K usually brought about by drying a soil.

Agron., Soils HD-3

N. Y.
(Cornell)

Studies of the Efficiency of Potassium Fertilizers in Relation to Plant Growth and Composition on Various New York Soils. 1. Studies of Potassium Fertilization of Corn with Special Reference to the Effects of the Chloride Ion. Study the effects of sources & rates of potash fertilizers applied in row & broadcast upon yield & plant tissue composition; study effects of chloride ion upon yield, plant tissue composition, & drought resistance.

Agron. 176-1

N. C.

The Effect of Potassium and Nitrogen Supply on the Growth and Development of Vegetable Crops. (1) Learn effect of anions & other exchangeable cations on leaching losses & fixation of K in soils & on uptake & utilization of K by plants; (2) ascertain influence of N and K supply on development of desirable plant parts during ontogeny with emphasis placed on sweet potato root enlargement; & (3) learn correct time, placement, & source of N & K for maximum vegetable production.

Soils 122

Ohio Factors Affecting the Release of Exchangeable and Non-Exchangeable Potassium From Soils. (1) Learn factors affecting release of nonexchangeable K to available forms in soil; (2) exchangeability and uptake of K from soils as affected by Ca saturation, type of clay mineral, rate of K applied, and type of extracting solution or type of plant grown; (3) study effect of N, phosphate, and other fertility or energy supplying substances on release and/or uptake of K by plants; and (4) correlate release and uptake of K by various extractants and by various plants with soil testing procedures in an effort to improve tests.

Agron. 47

R. I. Potassium Status of Soils After Long-Continued Fertilization with Different Potash Fertilizers. To (1) measure total, exchangeable, and various acid-soluble fractions of potassium in soils after 43 years of fertilization with different potash carriers; (2) compare effects of different ratios of N, P, and K on potassium status of cropped soils; and (3) relate removal of K, Ca, Mg, and sodium by forage crops to current fertilization and to various fractions of soil potassium.

Agr. Chem., Agron. 2

S. C. Potash Fertilization - Its Requirement by Agronomic Crops and Its Movement, Fixation, and Release in Soils. (1) Establish optimum economic levels of potash fertilizers for cotton, soybeans, and other agronomic crops for important soil types, (2) correlate available potash of soils as measured by quick test procedures with yields and uptake of important crops, (3) correlate application rates of potash, N, and phosphate of different ratios with yields of various crops, (4) investigate movement of applied K and release of soil K for several important soil types in state and (5) investigate response of certain agronomic crops to high analysis potash fertilizers.

Agron. 117

Tenn. Potassium Fertilization of Farm Crops on Different Soil Series in Tennessee. To determine effect of differential potassium fertilization on yield, plant composition, available soil potassium in a rotation, available soil potassium in a continuous cropping system, and longevity of an alfalfa stand.

Agron. 42

Tenn. A Study of the Degree of Substitution of Sodium for Potassium as a Requirement for Plant Growth and of the Essential Role of Potassium. Learn minimum basic requirement of K for tomatoes, strawberries, and other crops, and to ascertain its function. It is proposed to replace K with Na to point where depression of growth begins.

Hort., Soils 124 Coop. AEC

E. Minor Elements

Ala.

Minor Element Status of Alabama Soils and the Requirements of These Elements for Plant Growth. To (1) determine boron, manganese, zinc, copper, cobalt, and molybdenum status, with regard to the availability of these elements, in all major soil types of Alabama; (2) determine minor element fertility response of selected crops in soil areas known to be deficient in one or more minor element; (3) conduct greenhouse and lab experiments on various materials which may be used as sources of minor elements in plant nutrition; and (4) study residual effects in soils from various sources of minor elements.

Agron., Soils 205

Ariz.

Basic Principles Involved in Trace Element Nutrition of Crops and Availability in Calcareous Soils. To (1) develop procedures for estimating availability to crops of micronutrients in calcareous soils; (2) investigate factors affecting availability of certain micronutrients in calcareous soils; (3) determine effect of different degrees of micronutrient deficiencies on crop yield and quality; (4) evaluate availability of different single micronutrient fertilizers to plants; (5) study inter-relationships between rate of applications of major elements to soils and micronutrient deficiencies; and (6) investigate fundamental behavior of soil and foliar applications of chelated micronutrients.

Hort., Agron., Range Mgt.

Calif.

The Growth of Citrus and Other Crops as Affected by Minor Elements. To (1) develop methods of sufficient sensitivity for detection and estimation of Co, Cr, Ni, V, etc.; (2) investigate requirements of citrus and other crops for these and other elements and determine symptoms in deficiencies; (3) study toxic effects of various elements on crops; (4) study methods of application for essential minor elements and effects of treatment upon yield, growth, etc., of plants; and (5) study effects of variation in supply of minor elements upon absorption of major essential elements.

Plant Nutr., Soils, Hort. 1025

Storrs
(Conn.)

Chemical Properties of Connecticut Soils in Relation to Their Fertility. To learn (1) relative importance of Mn and Al as toxic factors for representative crop plants; (2) availability to crops of Mn and Al in Brown Podzolic soils at various levels of acidity; and (3) role of molybdenum deficiency as an infertility factor in acid Brown Podzolic soils.

Plant Sci. 269

Fla.

The Effect of Cu, Mn, Zn, B, S and Mg on the Growth of Grain Crops, Forage Crops, Pastures and Tobacco. Minor elements will be applied and other treatments varied to determine whether Mg or S are deficient. Chemical analysis of soil and plant material will be made when necessary.

Agron. 440

Fla.

The Interrelation of Environment to the Physiology and Chemistry of Plants. II. Organic Acid Metabolism of Plants in Relation to Minor Element Nutriton. Learn the organic acid content of certain species and inbred lines of plants grown under normal and deficient levels of minor elements, and relate variables to growth and quality.

Agron. 766

Fla.

Retention and Availability of Minor Elements in Florida Soils. Study soil factors governing retention of minor elements and learn optimum level of availability. Use everglades peat and Leon fine sand in studying organic matter retention of Al, Co, Cu, Fe, Mo, Mn, and Zn against removal by water, fertilizer solutions, 0.1 N HCl, and 0.1 N EDTA. In a similar study, use topsoil retention compared to subsoil retention to differentiate organic matter and inorganic colloid retentions.

Soils 813

Ga.

Effect of Lime on Availability of Molybdenum and the Resulting Influence on Yield and Mineral Nutrition of the Peanut and on Certain Other Minor Element Relationships. Learn (1) influence of lime on availability of Mo in representative soils of peanut belt; (2) study effect of lime on Mo uptake by peanuts; (3) measure combined influence of lime and Mo on mineral content to peanut; (4) establish level at which Mo becomes a limiting factor in production; and (5) where minor element deficiencies occur, study their relation to lime levels and other factors.

Agron. 44

Hawaii

The Copper Content of Hawaiian Soils and Economic Plants and Its Relation to the Growth of Plants and Health of Animals. To (1) determine total copper content of typical soils of each great soil group in Hawaii; (2) determine factors influencing availability of copper to plants; (3) determine copper content of economic plants, especially grasses on soils of the great soil groups; (4) make soil applications of copper to see if copper is the element responsible for nutritional disorders in plants; and (5) ascertain adequacy of copper content of plant tissue for health of animal by comparison with copper deficient areas of other regions.

Soils, Agr. Chem. 131

Hawaii

The Minor Elements in Hawaiian Soils and Their Relation to the Growth of Economic Plants. The Zinc Content of Hawaiian Soils and Its Relation to the Growth of Economic Plants. Corn will be used to establish the Zn deficient soils and then tomatoes, sweet-corn, lettuce, radish, cabbage, pepper and bush beans. Analysis of representative soils and plants will be made for their Zn content, including the quantity of exchangeable Zn.

Chem. 131.2

Idaho

Sulfur Studies on Crops in North Idaho Using Radioactive Sulfur. To (1) compare availability of sulfur to alfalfa, wheat and peat from two main sources, elemental sulfur and gypsum; (2) determine extent of sulfur uptake by those crops at various stages of growth; (3) determine distribution of sulfur; (4) determine effect of sulfur treatments on crop yields; (5) test "A" value concept for sulfur in those crops; and (6) carry over into the second year using alfalfa and peas as crops.

Agr. Chem., Agron. 208

Ill.

A Study of the Chemistry of Zinc and Molybdenum in Soils and Requirements of Crop Plants for These Nutrients. To (1) determine chemical forms of zinc and molybdenum in Illinois soils; (2) determine forms of zinc and molybdenum in soils that are available to plants and minimum levels needed for normal plant growth; (3) correlate amount of zinc and molybdenum in soil with amounts found in plants grown thereon; and (4) determine equilibrium reactions between native soil forms and added zinc and molybdenum.

Agron. 15-360

Ill.

Soil Requirements for Magnesium. To (1) examine current procedures for determining exchangeable magnesium on a rapid routine basis and to adopt a procedure which can be used in soil testing labs; (2) locate soil areas with different amounts of magnesium and having different proportions of magnesium in exchange capacity; (3) locate soil areas which contain low amounts of exchangeable magnesium or have a low proportion of exchange capacity occupied by magnesium; and (4) determine relation of soil levels of magnesium to crop response and establish levels at which magnesium deficiency may be expected in different crops.

Agron. 15-363

Kans.

The Roles of Zinc and Iron in Alfalfa and the Composition of Zinc Containing Substances in Alfalfa. Learn nature of chemical substances in plants to which Zn is bound, rate of uptake of Zn by plants grown in nutrient solutions, under various conditions and the relationship of Fe and Zn in plants, if such exists. Grow alfalfa in nutrient solutions with added radioactive Zn^{65}.

Chem. Bot. 328

Ky. Trace Elements in Fractions and Constituents of Kentucky Soils. To (1) develop spectrographic procedures for finding simultaneously a number of trace elements in soils, soil extracts and plant material; (2) determine total and "available" trace element content of representative soil types; (3) determine trace element content of plants grown on these soil types in order to correlate chemical methods of extracting "available" soil trace elements with amounts of soil trace elements extracted by plants; and (4) determine by soil fractionation and mineralogical investigations of these soils, which soil fractions are supplying, fixing, or otherwise affecting soil trace elements.

Agron. 167 (S-14)

La. The Distribution of Magnesium in the Soils of Louisiana as Related to the Growth of Certain Crops. To study (1) occurrence of easily soluble and exchangeable magnesium in more acid soils or soils low in exchangeable bases; (2) responses of crops on soils of low magnesium to various magnesium carriers; and (3) interaction between various additions of magnesium and responses of crops to native calcium, potassium, and phosphorus and to additions of these elements.

Agron. 384

La. Minor Elements in Soils. To (1) evaluate minor elements content of major soil types; (2) learn crop responses to minor element fertilization and balance required between elements; (3) evaluate merits of various carriers on soils; (4) study effects of varying levels of available minor elements on crops; and (5) study chemical behavior of minor elements, as affected by type of clay minerals, per cent saturation, and complementary ions.

Agron., Plant Physiol. 878

Mass. The Influence of a Chelate and Chelated Iron on the Availability of Iron to Plants in the Presence of Unavailable Iron. To ascertain effectiveness of certain chelates that carry iron in preventing iron chlorosis of plants grown in a nutrient solution, compared with use of iron derived from ferric phosphate; and (2) learn if sodium salt of EDTA will chelate the iron of the phosphate fraction and then release it for use by plants.

Bot. 21

Mass. Boron as Related to Soil Fertility and Crop Production. To (1) study plant and soil factors influencing B needs of different plants; and (2) evaluate the use of plant factors and soil tests in learning fertilizer B practices for different plants.

Chem. 28

Mass. The Effect of Iron Chelators on Nutrition of Roses. To determine the effect of iron chelators on foliar chlorosis and nutrition of roses, grown in soils with different levels of phosphate.
Hort. 60

Miss. Fertilizer Evaluation with Particular Reference to the Sulfur-Supplying Power of Surface and Sub-Surface Soils. To determine in greenhouse (1) period of time needed for sulfur deficiency to develop on various soils and in different localities under continued use of sulfur-free fertilizer by exhaustive cropping; and (2) relationship of yield and sulfur uptake to residual sulfur in soil and sulfur applied.
Agron., Soils HD-6 Coop. ARS

Mo. Minor Soil Elements. To evaluate the minor element content of the soils of the state and their limitations and beneficial effects on growth, composition and quality of agronomic crops as interpreted through chemical and biological assays.
Soils 92

Nebr. Trace Element Deficiencies in Nebraska Soils and Their Influence on Production and Quality of Crops. (1) Learn extent of deficiencies of Fe, Zn, Cu, Mn, B, and Mo in important soils of State; (2) study effects of different levels, forms, and combinations of trace elements applied to various soil types and directly to foliage of plants on production and quality of crops; and (3) evaluate soil and plant tests for determining available levels of trace elements in State soils.
Agron. 546

N. H. Effect of Soil Type and Mineral Additions on the Mineral Content of Clover and Timothy. To determine factors affecting minor element content of New Hampshire forage, the duration of effectiveness of an application of a minor element, and the effect of various fertilizer practices upon this duration.
Chem.(Agr.&Biol)71

N. J. Nutrient Ion Absorption - The Study of Ion Absorption and Accumulation in Relation to Plant Growth and Quality. To study (1) external and internal factors affecting absorption and utilization of Fe by plants; and (2) activity of Fe-containing enzymes in plants in relation to utilization and availability of Fe.
Plant Physiol. 501

N. J.

The Boron Requirement and Metabolism of Plants. To study (1) B requirements of different species of plants grown in sand or solution culture where levels of B supply can be controlled; (2) factors affecting utilization of B, including environmental influences and interaction with other elements; and (3) nature of role of B in metabolism of plants.
Plant Physiol. 502

N. Y.
(Cornell)

Control Methods for Magnesium Deficiency in New York State Apple Orchards. To find a means of control of magnesium deficiency which becomes effective more rapidly than present control methods.
Pomol. 139

Ohio

Factors Affecting Growth and Mineral Absorption by Plants. 4. Factors Affecting the Absorption by Soybeans of Native Soil Manganese and Applied Manganese. (1) Study effect of rate and placement of N, P, and K fertilizers applied individually and in combination on the availability to soybeans of native soil Mn, and Mn incorporated with fertilizers; (2) learn residual effect of applied Mn in light and heavy textured soils; (3) investigate relation between variation in soil temperature and soil moisture and apparent fluctuation in rate of absorption of Mn by soybeans; and (4) susceptibility of various varieties to Mn deficiency.
Agron. 1-4

Ohio

Chemical Estimation of Plant Available Soil Manganese. To evaluate (1) present chemical methods of estimating plant available soil Mn; and (2) develop promising PO_4 extraction methods of predicting plant available soil Mn.
Agron. 1-6

P. R.

Effect of Minor Elements upon the Growth and Composition of Economic Crops. To (1) determine if main cultivated crops in Puerto Rico respond to application of minor elements when grown in more important soil types of the Island; (2) determine effect of minor elements upon composition of economic crops; and (3) study relation between pH of the soil and minor element availability.
Agron., Hort. 54

S. C.

Boron Fertilization in Relation to Yield and Quality of Crops. To (1) determine most suitable forms and rates of boron to add to general mixed fertilizers so they will supply boron needs of most crops without harmful effect on more sensitive plants; (2) availability of boron compounds to plants and residual effect on soil of major soil series; (3) evaluate effect of boron on yield and quality of crops; and (4) study effect of boron on absorption of other nutrients by plants.
Agron. 13

S. C. Nutrient Applications as Affecting Yield, Longevity of Stand, and Chemical Composition of Alfalfa. To determine (1) yield response from applications of boron and boron with copper, manganese, zinc, and molybdenum; (2) most satisfactory stage of growth for harvesting; and (3) most favorable treatments and practices affecting longevity of stand.
Agron. 114

S. Dak. Selenium Poisoning. To (1) obtain basic information on biochemistry and physiology of selenium toxicity in animals; (2) determine with lab animals methods to counteract toxicity of selenium; (3) adapt information now available and that obtained thru objective 2 on factors which alleviate selenium toxicity in small animals for use in farm animals; (4) explain metabolism of selenium by plants, to establish chemical forms of selenium in plants and determine toxicity of compounds isolated; and (5) adapt basic information obtained from plant, geologic and soil studies in past to practice of mapping seleniferous land in detail.
Biochem. 19-R

Tenn. Trace Elements in Tennessee Agriculture Crops. (1) Learn which soil properties are associated with trace element deficiencies; (2) study ways by which trace element deficiencies may be corrected; (3) establish levels of trace elements in soils and plants associated with deficient and normal growth of several crops; and (4) relate trace element content of plants to their content of other mineral elements.
Agron. 56

Tenn. Minor Element Nutrition as Related to Horticultural Production on Tennessee Soils. To (1) determine present status of minor element levels in horticultural crop production; (2) determine effects of additions of minor elements and combinations of these materials on crop growth and yield of harvested products; and (3) study possibility of leaf, or other tissue analysis methods as means of discovering incipient shortages of minor elements.
Hort. 123

Utah Minor Element Deficiency Diseases of Horticultural Crops in Utah. To (1) determine nature and extent of minor element deficiency diseases of horticultural crops in Utah; (2) investigate practical procedures for prevention and control of these diseases; (3) investigate certain fundamental aspects of chlorosis with use of radioiron; and (4) investigate physiological activities of plants that are susceptible and that are resistant to chlorosis.
Agron., Bot. 346 Coop. AEC

Va.

Boron Nutrition of Plants. To study (1) boron requirements of apples; and (2) relationship between volatility of boron in ashing of plant samples and boron requirements.

Plant Path., Physiol. 86028

W. Va.

The Molybdenum Status of West Virginia Soils. To learn (1) total molybdenum content of a number of important West Virginia soil types; (2) response of farm crops to molybdenum application; and (3) develop a method for estimating availability of molybdenum as measured by crop response.

Agron., Genet. 104

F. Lime

Ala.

The Effect of Lime on the Physico-Chemical Properties and the Availability of Plant Nutrients in the Soil. To secure information from which injurious effects of lime may be avoided, including determination of optimum pH levels for production of various crops on Alabama soils, study of effects of liming on availability of essential nutrient elements to crops, and determination of practical methods of bringing over-limed and unproductive soils back to normal productivity in the field. Also to determine rate of reaction of liming materials and their physico-chemical effects upon soils, including studies of physical and chemical properties of liming materials; determination of extent that various soil properties such as pH, type of soil colloid, and content of exchangeable nutrients affect the needs of soil for lime; and studies of methods and rates of application of lime for giving the best results in the establishment of stands and yields of various legumes.

Agron., Soils 305

Hawaii

Lime Experiments on Coffee Soils. (1) Learn if very acid soils having a low lime content require application of lime for maximum production of coffee; and (2) effect of lime application on level of Ca, Mg, and Zn.

Agron., Soil Sci. 135

Maine

Use of Lime on Agronomic Crops Grown in Maine. To (1) determine response to lime by various crops; (2) evaluate, chemically, availability of plant nutrients at varying pH levels; (3) test efficiency of various liming materials as to ability to change pH of a soil; and (4) compare various methods and times of application.

Agron. 43

N. C. Sources of Limestone to Supply Calcium and Magnesium for Optimum Production and Quality of Crops. To (1) determine suitability of various liming materials to supply calcium and magnesium for optimum crop production; (2) study factors influencing rate of reaction and availability of calcium and magnesium, including type of colloid, cation and anion exchange properties, and plant species; and (3) determine measures needed to counteract over liming injury.
Soils H-112

Ohio Lime-Phosphate Studies. - 1. Liming Materials Studies. To (1) develop lab test for rapid evaluation of liming materials, to be correlated with tests of activity of the materials in soils and so indicate probable rate of supplying active lime under field conditions or soil neutralizing activity in practice; (2) determine relative and so far as possible absolute rates of dissolution and neutralizing activity of limestones and dolomites from important sources, and of other liming materials such as slags, and study effect of characteristics of materials; and (3) develop practical lab method for reliable quantitative evaluation of exchangeable hydrogen or unsaturated exchange capacity of soils.
Agron. 9-1 Coop. ARS

R. I. The Cumulative Effects of Liming and Composting on Velvet Bent Turf. Learn effect of continued applications of various amounts of lime and compost on growth and vigor of velvet bent grass, the accumulation of organic matter in the soil, the rate of penetration of lime into the soil and on change of pH at various soil depths.
Agron. 210

R. I. The Effect of Liming on Soil and Fertilizer Phosphorus Fractions. To determine (1) effect of liming on availability of native soil P; (2) changes in P fractions of established soil P levels; and (3) response of crops to changes on P status of soil.
Agron., Agr. Chem. 213

Va. Lime Requirements of Virginia Soils. To learn lime need of certain Virginia soils for optimum plant growth; the soil properties causing differences in amount of lime required for optimum plant growth. To develop improved methods for diagnosing lime needs of state soils.
Agron. 86084

W. Va. Lime, Fertilizer and Barnyard Manure Used on West Virginia Farms. To investigate lime, fertilizer and barnyard manure used to determine the kind, amount, source, cost, use, and method of application.
Agr. Econ., Agron. 41

G. Mixed Fertilizers - Rates, Placement

1. Forage Crops

Storrs
(Conn.)

The Effects of Various Pre- and Post-Seeding Practices on the Establishment of Legume-Grass Mixtures. To determine how establishments of legume-grass seed mixtures are affected by: presence of, and time of harvesting a companion crop; clipping treatments; and kinds, rates and placements of fertilizers.
Plant Sci. 219 (NE-29) Coop. USDA

Fla.

Pasture Grass and Legume Responses to Various Fertilizer and Management Practices. To evaluate rate, ratio, method and time of application of major and minor nutrients to grasses, legumes and grass-legume combinations as measured by herbage yield, cattle gains, and chemical and botanical composition.
Agron. 295

Ga.

Effects of Potash, Borax, and Other Fertilizer Elements on the Yield, Composition, and Longevity of Alfalfa. To determine (1) most efficient rate of fertilization for highest hay yields, quality, and most persistent stands; and (2) best method of fertilizer placement.
Agron., Forage 38

Ill.

Legume-Grass Mixtures for Hay Production. To (1) determine effect of various grasses on prevention of heaving in alfalfa; (2) measure yield of grasses in combination with alfalfa, sericea, and birdsfoot trefoil; (3) evaluate grasses in combination with alfalfa, trefoil, and sericea in weed control; (4) study longevity of above grasses with 7 grass combinations; and (5) study establishment, yield and survival of sericea, lespedeza, alfalfa, and birdsfoot trefoil under different fertility levels. Use 8 levels of fertility for sericea plots.
Agron. 40-303 (Dixon Springs)

Ill.

Effect of Fertilization on Longevity and on Yields of Alfalfa. Study the possibility and desirability of lengthening productive life span and yield of alfalfa stands by fertilization on Grantsburg silt loam.
Agron. 40-337 (Dixon Springs)

Md. Alfalfa Fertilizer Practices. To study fertilizer rates and ratios in reference to soil type and time of application; (2) compare a single application once in 3 years with annual applications, both having same amount of total fertilizer applied in a 3-year period; (3) study spring applications of commercial fertilizer, just as visible growth starts, vs. fall applications of commercial fertilizer on alfalfa in early September, after last cutting, and (4) study minor elements when and where evidence indicates they are limiting yields.
Agron., Soils 0-51

Mo. Soil Treatments for Alfalfa. To determine (1) fertilizer treatments and soil management practices to increase alfalfa production; and (2) soil treatments for alfalfa grass mixtures.
Soils 242

N. J. Nutritional Requirements of Certain Grasses and Legumes and Their Response to Fertilizer Treatments. (1) Study response of alfalfa to various combinations of N, P, & K; (2) determine rates and ratios of fertilizer best suited to alfalfa culture; (3) investigate most effective time of year to fertilize alfalfa; and (4) study the relationship between cutting treatments and N applications regarding yield and persistence of bromegrass.
Farm Crops 264

Okla. The Effect of Rate of Seeding, Spacing and Fertilization on Alfalfa Seed and Hay Production. To determine (1) relative effectiveness of kinds and amounts of commonly used phosphate fertilization materials alone, and combined, on growth of alfalfa; (2) interaction of various plant nutrient levels influencing alfalfa yields to determine most efficient level of fertility to be maintained with commercial fertilizer; (3) secondary and trace element requirement of alfalfa in Oklahoma soils; (4) soil fertility requirement of alfalfa grown with warm and cool season grasses under irrigation; and (5) performance and production of alfalfa and grass combination under irrigation when used primarily for irrigated pastures.
Agron. 680

(For more information on research in this category, see II, E, MANAGEMENT, Pasture and Forage, Including Fertilization.)

2. Field Crops

Ark. Fertilizer Studies with Cotton and Soybeans. - Cotton: (1) Compare anhydrous ammonia, urea, N solutions, and any other newer source of N that may become available with ammonium nitrate when applied in fall, winter, early spring, just before planting, and as sidedressing; (2) study time of application of various fertilizer elements; (3) evaluate methods of application of elements singly and in combination on germination, growth, maturity, and yield; (4) evaluate varying rates of application of high and low analysis fertilizers, with limestone applications where needed, on growth, yield, maturity, and quality; (5) learn differences between high and low analysis fertilizer; (6) evaluate residual effects of fertilizer applications; and (7) study fertilizer response as related to results of chemical soil tests and to soil types. Soybeans: (1) learn best P-K ratio for beans on major soil areas; study (2) methods and time of application of P-K fertilizer to beans at certain selected sites; (3) possible effect of a starter application of N on bean growth, development and yield; and (4) effect of sidedressing N at different growth stages of bean growth, development, yield and quality.
Agron. 444

Colo. The Effect of Fertilizers on the Yield and Quality of Crops Under Dry Land Conditions of Colorado. To determine (1) conditions in dry land areas affecting crop response to fertilizers including soil type, cropping system, climate, available soil moisture, initial level of available nutrients, and crop species; and (2) comparative effectiveness of different types and combinations of fertilizer elements as well as rate, time, method of application of fertilizers on yield and quality of field crops.
Agron. 18

Fla. Fertilization and Culture of Flue-Cured Tobacco. To determine the influence of fertilization, irrigation, and soil fumigation on flue cured tobacco.
Agr. Engin., Agron. 555

Ga. The Effect of Fertilizer Ratios and Methods of Placement on Peanut Yields. To (1) determine most profitable ratios and rates of fertilizers for use on peanuts; (2) determine optimum placement of peanut fertilizers; and (3) develop satisfactory equipment for optimum fertilizer placement when determined.
Agr. Engin. 20 Coop. ARS

Ga. The Effect of Varying Soil-Management and Cropping Practices upon the Fertilizer Requirements of Small Grains. To determine (1) most profitable rates and ratios of fertilizer for small grains on different soils, following continuous cropping, and in rotation with legumes; (2) effects of disease on yield of small grain under continuous cropping system; and (3) yield interaction between varieties and fertilizer.
Agron. 28

Maine Variety Testing, Cultural Practices and Fertilization of Small Grains. (1) Develop small grains by introduction, selection and testing; (2) learn best fertilizer applications, row spacings, seeding dates, and other cultural practices needed for most efficient small grain production; and (3) learn effect of rate of application of N, P, and K in relation to seeding date, growth, yield, and quality.
Agron. 73 Coop. ARS

Mo. Soil Fertility and Cotton Production. To learn effect of N, P, K, Ca, Mg, S, and trace elements on yield, maturity and quality of cotton both with and without supplemental irrigation.
Soils 267

Mo. Soil Fertility and Corn Production. To learn proper use of fertilizer nutrients in connection with other management practices, for most efficient production of corn on various soils of state.
Soils 268

Miss. Small Grain Production as Affected by Fertilizer Rates, Fertilizer Placement and by Stand. To learn efficiency of phosphate for (1) forage production as affected by banded and broadcast applications, and by ammoniation; (2) grain production as affected by time and method of application; (3) learn yield of grain and extent of lodging as affected by conventional row seeding and restricted broadcast seeding at variable rates of seeding and at varying N levels.
Agron., Soils HD-5

N. C. Soil Fertility and Cultural Practices in Small Grain Production. To study (1) N fertilization and other needs of small grain as related to preceding crop and soil characteristics; and (2) effects of sources of phosphorus on growth and yields of small grain and the following crop of lespedeza.
Soils 114 Coop. TVA

N. Dak. The Effect of Commerical Fertilizers and Plant Population on Yield and Soil Moisture Utilization by Corn. Learn effect of fertilizer and plant population on development and yield of corn and effect of soil moisture status under growing corn. Interaction of fertilizer with population will include hill applications of P, P with N and complete fertilizer, and plow down treatments of N and P, with and without hill applications.
Agron. 15-6

Nev. Soil Fertility Problems of Cotton in Southern Nevada. To learn (1) response in cotton in early maturity and total yield to varying applications of N, P, and K; and (2) relative merits of liquid vs dry fertilizer.
Agron. 34

Ohio Potash and Nitrogen Requirements of Corn and Oats as Affected by Sweet Clover and Other Crop Residues. To determine (1) rate of potash fertilization required to maintain crop yields where sweet clover is used as green manure for corn; (2) comparison of sweet clover and chemical N as sources of N for corn, alone and in combination with crop residues; and (3) influence of sweet clover alone and in combination with residues on the supply and release of soil potash at different rates of K fertilization.
Agron. 26

Okla. Commercial Fertilizer Studies in Western Oklahoma. To learn (1) N and P needs of soil types for high levels of crop production in Western Oklahoma, and best time for applying N fertilizer for wheat in same area; (2) correlate crop response to N and P fertilizers with soil chemical tests; and (3) relate moisture status of soil to crop response under varied rainfall and soil conditions.
Agron., Soils 912 Coop. ARS

Okla. Management of Soils for Sorghum Production. (1) Ascertain influence of added N, P, and K on grain and forage sorghum production; correlate soil tests for P and K with yield and response from added N, P, and K; compare sources of N and P on grain and forage sorghum production; ascertain residual effects of N, P, and K; (2) study soil moisture use under several soil fertility and climatic regimes, and fertilizer irrigation interaction; (3) study depth and lateral displacement of fertilizer as it affects stand, time and rate of seedling emergence, salt injury, and yields; and (4) study sorghum production in several cropping systems and influence of cropping systems on: moisture use and storage thru year, and organic matter maintenance and soil structure.
Agron. 962

Okla. *The Relationships of Soil and Fertilizer Treatments to Wheat Production.* To learn (1) effect of plowpan disruption; (2) effects of two methods of residue management; (3) if response of wheat to fertilizer varies with residue management and pan disruption; and (4) N and P needs of wheat on soil continuously cropped to wheat.
Agron. 1002 Coop. ARS

Pa. *Fertilization and Management Practices for Corn Production.* To evaluate (1) effects of fertilizers, fertilization practices, and varying plant populations on the efficiency of production using new recommended hybrids in typical corn producing sections of Pennsylvania; and (2) soil physical and chemical properties which affect corn production.
Agron. 911-D

3. Vegetable Crops

Ark. *A Study of Amounts, Timing and Placement of Nitrogenous Fertilizers in the Production of Green Crops.* To learn (1) relationship between amounts, time of application and placement of varied nitrogenous fertilizers for green crops; and (2) if quality in crops is affected by amounts, timing and placement of fertilizers.
Hort., For. 417

Ariz. *Lettuce Physiology - Cultural Factors Affecting the Production of Lettuce in Arizona.* (1) Gain additional information relating to physiology and environmental factors influencing growth behavior of lettuce in order to develop cultural measures for improving production and quality; and (2) learn optimum rates, proper ratios, and time of application for N, P, K and organic matter, as barnyard manure and cover crop residue. Apply nutritional leaf sprays.
Hort. 298

Colo. *The Effect of Various Fertilizers, Minor Elements and Soil Amendments on the Yield, Grade, Color, Cooking Quality and Keeping Quality of Potatoes.* (1) To determine the soil factors influencing skin color, tuber type, yield, size, and quality of red potatoes in the San Luis Valley; (2) to study the effect of soil applications of different types; and (3) to develop a control method.
Hort. 45

Storrs (Conn.)

Fertilization of Potatoes. To determine effects of all major and minor plant nutrients at several rates on yield and quality of potatoes grown (1) under continuous culture; and (2) in rotation with various crops.
Plant Sci. 158

Del.

Cultural Problems of Asparagus Production in Delaware. (1) Learn best use of fertilizer including minor elements; (2) ascertain if previously found good fertilizer and cultural practices will improve yields when combined in a single treatment; and (3) accumulate data toward establishment of optimum nutrient levels in asparagus through spectrographic tissue analysis.
Hort. 10-H

Fla.

Effect of Various Levels of Fertilizers on Sweet Potato Production. To study the effects of rates of fertilizers on the yield and market quality of sweet potatoes.
Veg. Crops 681

Ga.

The Effects of Placement Depth and Location of Fertilizer Upon the Growth and Yields of Pimiento and Other Vegetable Crops. (1) Learn effect of placement depth and location of fertilizers on growth and productivity of pimiento and other vegetables; and (2) devise equipment and methods for efficient placement of fertilizer at optimum depths.
Hort., Agr. Engin. 93

Iowa

Cultural Studies with Canning Crops. To (1) study rates and methods of fertilizer applications; (2) determine most efficient rotation for canning crops; (3) evaluate different methods and rates of planting; (4) determine most efficient methods and amount of cultivation for row crops; (5) study effects of fungicides on control of leaf defoliating diseases of tomatoes; (6) secure information on effects of growth substances on blossom drop as influenced by environmental conditions and variety; and (7) determine effects of above objectives on quality of canning crops.
Hort., Bot., Agron., Plant Path. 1105

Ky.

The Effect of Timing and Balancing Mineral Nutrients on the Growth and Quality of Tomatoes. Study growth of plant as influenced by applications of different amounts of fertilizer, learn best time and method for applying each and note correlation between amount of nutrient absorbed by plant and quantity applied to soil and response of plants on different nutrient levels to supplemental irrigation.
Hort., Agr. Engin., Soils 556

Maine Fertilization of Potatoes. To (1) evaluate practices of heavy fertilization as to kind and amount of fertilizer used for most economical yields of good quality potatoes; (2) test new fertilizer materials showing indications of being of value in production of potatoes; (3) perform current survey tests in order to test any nutrient element deficiencies; and (4) evaluate residual effect of fertilizer applications.
Agron. 10

Maine Adaptation of New Potato Varieties to Maine conditions and Marketing Needs. To (1) evaluate new potato varieties as to their adaptation to Maine growing conditions and their potential place in Maine potato industry; and (2) learn optimum rate of fertilizer and optimum seed piece spacing for new varieties.
Agron. 19 Coop. ARS

Maine Effect of Fertilizers, Liming, and Cultural Treatments on Crops for Processing. To (1) further study amounts and ratios of fertilizer needed to produce large yields of high quality processing crops; (2) further study amounts of liming materials needed to maintain given pH and calcium levels in soil, without increasing incidence of potato scab, and effect of these different levels on yields; (3) determine most efficient placement of small amounts of lime and effect on yields; (4) study most efficient placement of fertilizer and proper time of application in rotation; (5) determine best seeding rates for peas, sweet corn, and beans, and proper spacing of broccoli plants commensurate with highest yields of processing materials; (6) study effects of side-dressing applications with N at various times upon growth and quality of beans, sweet corn, and broccoli; (7) study and improve planting, cultivation, and harvesting practices for processing crops; (8) determine adaptability of new varieties for processing in Maine; (9) study effects of growth regulators and nutrient sprays on maturation and fruit-setting in beans and peas; (10) evaluate effect of harvest date on yield and quality of beans and peas; (11) determine if early removal of primary head of broccoli can be done without reducing yield; and (12) study effect of field freezing on broccoli quality.
Hort., Agron. 74

Mass. Production of Local Vegetables for Prepackaging. Study influence of fertilizer application and plant spacing, varieties, and similar factors on adaptability of local lettuce, spinach, and celery for prepackaging.
Hort. 91

Miss.

Fertilizer Evaluation with Particular Reference to Sulfur in Cabbage and Turnips. To determine (1) effect of using high analysis fertilizers alone and with additions of sulfur on yield and sulfur content of cabbage and turnips on Verona sandy loam, shallow phase; (2) residual supplies of sulfur in various horizons of the soil and relate these to amounts of sulfur available to crops; (3) period of time needed for sulfur deficiency to develop in cruciferae crops on this soil under continuous use of sulfur free fertilizer; and (4) amount of sulfur needed to correct deficiency if it occurs.
Hort. HK-23 Coop. USDA

Mont.

Fertilizing Vegetable Transplants. To determine (1) fertilizer influences in the growing of the transplants; (2) influence of various types of starter solutions upon transplants grown with varying fertilizer treatments; and (3) effect of transplant fertilization on the field fertilizer program.
Hort. MS 532

N.Y.
(Cornell)

Fertilizer and Soil Management Studies with Market Vegetables and Dry Beans. To study methods of maintaining high yields of market vegetables in intensively cropped areas of New York and to determine best methods of fertilization and soil management for dry beans for the wide range of soil type on which they are grown.
Veg. Crops 168

N. Y.
(Cornell)

Fertilizer and Soil Management Studies with Potatoes in Upstate New York Areas. (1) Learn most efficient rate of N, P, and potash on muck and mineral soils and correlate results with soil tests; (2) learn cultural practices that may be effective in alleviating an Fe, Al, and Mn toxicity; (3) learn if Long Island plow plant method is adaptable to heavier stony soils of upstate. Note effect on yield and soil structure; and (4) learn effect of above factors on total yield, marketable yield and weed control for several commercially important varieties differing in respect to depth of tuber set.
Veg. Crops 169

Pa.

Interrelations Among Varieties, Fertilizing Treatments, Spacings and Locations of Tomatoes, Peas, Beans and Sweet Corn. To determine (1) adaptation of various varieties to soil and climatic conditions of canning areas; (2) efficiency of various methods of applying fertilizers; (3) most feasible spacing distances; and (4) relationships between and among varieties.
Hort. 1023

R. I. A Study of the Economical Fertilization of Irish Potatoes. To (1) determine fertilizer ratios best suited to production of optimal yields of potatoes in Rhode Island; (2) determine economical amounts of commercial fertilizers needed to maintain yields under continuous potato culture; (3) study need of organic matter in soils continuously used for potato growing; and (4) compare continuous potato culture with potatoes grown in rotation with redtop.

Agron., Agr. Chem. 206

4. Miscellaneous Crops

Fla. Fertilization of Pecans. To determine effects of differential fertilization with calcium, potassium, magnesium, and other nutritive elements on yields, and condition of pecans.

Hort., Soils 565

Ill. Nutrition of the Greenhouse Rose in a High Boron Soil. To learn best levels of N, P, and K for growth of greenhouse roses in a soil containing high to toxic qualities of B, taking into consideration number of marketable flowers, size and appearance of blooms, their color and ability to keep well in both commercial storage and home, as well as resistance to insects and diseases.

Hort., Soils 65-351

Ind. Phosphorus and Potassium Fertilizer Practices. To evaluate combinations of broadcast and row fertilization with phosphorus and potassium fertilizers and to determine levels of these nutrients needed for maximum and economic production.

Agron. 665

Ind. Fertilization of Christmas Trees. To determine effects of fertilization on Christmas tree foliage color.

For. Conserv., Agron., Hort. 757

Ind. The Relation of Soil Fertility Level to the Growth of Forest Trees. To learn (1) effect of various levels of N and P on tree growth in upland-hardwood stands situated in the sandstone-shale area of southern Indiana; and (2) if forest productivity potentials can be estimated using the Purdue Quick Tests.

For., Agron. 887

Maine Fertilizer Experiments with Apples. To (1) determine effect of major nutrient elements and mulches on yield and quality of apples; (2) determine if effect of mulching can be attributed to addition of mulch itself, or to addition of extra nutrients it contains; (3) study effect of two N rates with and without supplemental Mg on growth and yield of young apple trees; (4) study effect of several mulch materials on root distribution of young apple trees; and (5) establish general levels of nutrition in apple trees thru the state by use of foliar analysis.
Hort. 8

Mont. Fertilizer Influences on Sweet Cherries. To determine (1) influences and places of commercial fertilizers in sweet cherry production; (2) ratio and level of nutrients and consitutents affecting fruit set, time and evenness of maturity, and leaf area and fruit size and quality; and (3) quantities present of main constituents as influenced by soil treatment and fertilizer applications.
Hort. M.S. 719

Mo. The Effect of Deep Fertilization on Runoff and on Yield of Corn, Wheat and Alfalfa. To determine under field conditions: (1) yield effect of N in subsoil with and without deep placement of other plant nutrients; (2) effect of deep treatment from field sized terraced areas; and (3) optimum depth and method of treatment.
Soils 70 Coop. USDA

Mo. Greenhouse Flower Crop Production. (1) To learn relation of soil analysis to flower production and quality; (2) study greenhouse cooling and its effects on flower production; and (3) learn factors affecting keeping qualities of cut flowers.
Hort. 293

Nebr. Commercial Fertilizers and Manures for Farm Crops in Nebraska. To (1) compare effects of bromegrass, alfalfa, sweet clover, legume-grass mixtures and commercial nitrogen on soil nitrogen maintenance as measured by crop yields, crop composition and soil composition; (2) establish time, method and rate of application of different kinds of nitrogen and phosphorus fertilizers for farm crops; (3) determine influence of residue management and commercial fertilizer applications on production of wheat in Western Nebraska; and (4) determine need for lime, potassium, magnesium, sulfur, and minor elements for farm crops.
Agron. 104 Coop. ARS

Nebr. Response of Trees to Certain Commercial Fertilizers Applied at Time of Planting. Learn effects of application of following on survival and growth of newly planted seedling trees on a wide variety of sites: NH_4NO_3; concentrated superphosphate; muriate of potash; mixture of NH_4NO_3 and concentrated superphosphate; mixture of NH_4NO_3, concentrated superphosphate, and muriate potash.
Hort., Agron. 571 Coop. SCS

N.J. Nutrition of Blueberries and Cranberries. To (1) conduct survey of blueberry fields to learn pH range for growing blueberries profitably; (2) determine effect of applications of lime on productivity of blueberry bushes in soils of pH below 4.3; and (3) re cranberry fertilizers: time and number of applications; importance of N, P, K, B, Mg, Zn, Cu, and Mn; soil moisture; sources of N; rock phosphate vs. superphosphate.
Hort. 360

N. Dak. Effect of Fertilizer on Selected Farm Crops Grown Under Irrigation on a Number of North Dakota Soils. To (1) obtain data to provide basis for sound recommendations for use of fertilizers on alfalfa; (2) obtain data on fertilizing corn and small grains used as nurse crops for legume or legume grass seedings; and (3) relate results of treatment to profile characteristics such as texture, available phosphorus, pH, organic matter, lime and soluble salt content.
Soils 15-5

Oreg. Nutrition of Tree Fruit Crops in the Mid-Columbia Area. To learn (1-5) (1) nutritional status of orchards; (2) N and mineral nutrient needs for various fruits grown in area; (3) amounts of fertilizers needed to maintain orchards at or above critical nutrient level; (4) effects of climate on use of plant nutrients and on tree response to applied fertilizers; (5) effect of fertilizers upon uptake and use of nutrient elements with special reference to tree response in growth and productivity; (6) correlate plant and soil composition in development of possible diagnostic and prognostic procedure; (7) evaluate effects of nutrients and of added fertilizer on storage life, superficial and ground color, flavor, texture, firmness and size; and (8) develop techniques and catalogue information for differentiating between symptoms of mineral deficiencies or excesses and symptoms or expressions of plant viruses, with special reference to stone fruit.
Hort. 277

Pa. *Short Duration Fertilizing Experiments Involving a Coordinated Study of the Amount and Kind of Fertilizers and the Time and Method of Application Best Suited to Pennsylvania Crops, Soils, and Conditions*. To determine (1) by farm trials what changes may be made in the amounts and analysis of fertilizers used on various farm crops and most suitable methods of applying such fertilizers for more economical production; (2) extent to which past soil management practices determine the analyses and amounts of fertilizer required; and (3) time of season applications should be made.
Agron. 749 Coop. FES

P. R. *Effect of Nutrient Applications on Coffee Yields in Puerto Rico*. To determine the minimum nutrient applications necessary to maintain maximum yields of the most promising coffee varieties in Puerto Rico.
Agron., Hort. 20 Coop. ARS

Tenn. *Mineral Nutrition of Fruit Crops*. (1) Determine place of various minerals in fruit production in State in order to increase fruit yields and improve fruit quality; (2) relate fertility levels to seasonal plant response, particularly with reference to winter hardiness; and (3) determine influence of minerals on behavior of fruit crops under cover crops and behavior of cover crops.
Hort. 125

(For more information on research in this category, see II, Management.)

H. Miscellaneous Fertilizer and Lime Studies

Fla. *Development of Adequate Sampling Procedures for Mixed Fertilizers*. To eliminate bias and reduce errors in sampling mixed fertilizers.
Soils, Agr. Engin. 753

Ga. *Application of Liquid and Solid Fertilizer Materials*. (1) Simplify and increase reliability of equipment for distributing liquid fertilizer materials, and compare economy of their use with solid fertilizers; and (2) develop placement equipment and compare effects of solid fertilizer materials when placed at different depths, banded singly and mixed with the soil for different soils and crops.
Agr. Engin., Agron. 23

Ind. Pricing and Marketing of Fertilizer in Indiana. To learn (1) pricing and marketing patterns for fertilizer materials, with emphasis on prices for newer types of material; and (2) extent to which price differentials for comparable fertilizer materials reflect cost of tie-in services and/or credit; lack of knowledge by farmers of physical characteristics of available materials; existence of discriminatory prices and sales policies by fertilizer manufacturers and/or distributors.

Agron., Agr. Econ. 847

Iowa The Long-Time Effects of Lime, Fertilizers, and Manure on the Productivity of Soils. To determine (1) optimum level of liming for various crops in a rotation, particularly legumes; (2) value of rock phosphate and super-phosphate when applied separately and in combination and determine comparative residual effects of these two sources in relation to rate of application; (3) long-time effects of N, manure, phosphate, and potash on crop growth; (4) on a long time basis, relative availability of P in various P carriers to crops in relation to soils factors influencing phosphate availability; (5) long-term fertility practices for pastures on different soil types and relative responses of grasses and legume to different fertilizer elements, lime, and manure; and(6) when fertilizers should be applied in rotation to secure most efficient use of fertilizer by various crops.

Farm Crops, Soils 1148 Coop. TVA

Ky. An Economic Study of Nitrogen and Potassium Fertilization of Corn. To determine (1) most profitable rate of N application with K held constant at various levels; (2) most profitable rate of K application with N held constant at different levels; (3) least cost nutrient (N and K) combination for yields at different levels; and (4) economics of residual effects of above fertilizer applications on succeeding corn crops.

Agron., Agr. Econ. 21

La. The Application of Soluble Fertilizers in Sprinkler Irrigation Lines, and Head-Loss Curves for Aluminum Irrigation Pipe with Quick-Couplers. To learn (1-4) feasibility of applying soluble fertilizers in irrigation water being distributed in sprinkler systems; (2) extent of loss of fertilizers due to vaporization when applied in sprinkler systems; (3) nature, extent, and results of reactions occurring in different Louisiana waters when mixed with soluble fertilizers of different formulations; (4) formulations of N, P, and K best suited for application in irrigation water; and (5) Develop head-loss curves for aluminum irrigation pipe with quick couplers.

Agr. Engin., Soils 894

Minn. Soil Fertility Investigations. 4. Experiments with Fertilizers and Soil Amendments. To (1) test and evaluate new fertilizer materials as to effectiveness, ease of application, economy of crop production, and other factors; (2) study rates, placement, and time of application of fertilizers and manures as these influence crop yield, quality and soil properties; and (3) investigate effectiveness of soil amendments in respect to form, rates of application, time and manner of application as they affect crop yield, quality and soil properties.

Soils 2504

Nebr. Improvement of Soil Management Practices with the Aid of Radioactive Isotopes. To (1) determine efficiency of fertilizer use as influenced by placement, kind of crop, soil type, and presence or absence of other fertility nutrient; and (2) evaluate phosphorus status of major soils and influence of past management on current fertility status of major cropped soils, and to calibrate lab soil tests with these data.

Agron. 412

N. J. The Value and Use of Natural and Industrial Materials for Soil Improvement. To (1) develop procedures for evaluation of these materials; (2) evaluate effects of same on physical, chemical, and biological processes in soil and effects on crop yields and chemical composition of plants; (3) learn methods of treating to increase effectiveness and learn value of these products in other phases of agricultural industry.

Soils 647

Ohio Marketing of Fertilizers in Ohio. (1) Study methods of fertilizer distribution and emphasize costs of providing various services; (2) learn economic sources of supply for farmers delivered bulk fertilizers and study changes in warehouse facilities needed to provide most efficient service to farmers; study (3) changes in method of farmer credit used in fertilizer purchases as it affects the new method of distribution; and (4) effects that new methods of fertilizer distribution will have on firms previously handling the product.

Agr. Econ., Rural Sociol. 177

Oreg. Economic Analysis of Fertilizer Use on Grain Crops in Eastern Oregon. Determine optimum levels of fertilizer application under specified conditions. A questionnaire will be mailed to a number of farmers to learn extent of use, kinds of fertilizers and rates of application. Determination of optimum fertilizer rates under specified price conditions by equating marginal returns of fertilizer with its costs; determination of returns for varying amounts of capital invested in fertilizers; determination of factors influencing yield response to fertilizer and extent of their importance insofar as they can be measured.

Agr. Econ. 303-2 Coop. ARS

Oreg. Economic Analysis of Fertilizer Use on Wheat in the Columbia Basin. (1) Investigate most profitable levels of fertilizer application and costs and returns associated with the practice; (2) equate marginal returns of fertilizer with its cost to learn optimum rates under specified price conditions; (3) calculate costs and returns for varying rates of application; and (4) study factors influencing yield response to fertilizer and the extent of their importance insofar as these factors can be measured.

Agr. Econ. 303-3 Coop. ARS

Texas An Economic Study of the Experimental Response to Fertilizers. To learn (1) response obtained from various levels and combinations of principle plant nutrients for various crops; (2) most profitable level and combination of principle plant nutrients over a range of economic conditions; and (3) influence of various causes of uncertainty on making the optimum fertilizer decision.

Agr. Econ., Agron. 1006 Coop. ARS

W. Va. The Marketing of Lime and Fertilizer in West Virginia. To study methods of lime and fertilizer distribution with a view of reducing cost and/or improving service between producer and consumer (farmer).

Agr. Econ. 259, ES 701 Coop. FCS

II. MANAGEMENT

A. Rotations

Ark. Rotations and Fertilizer Experiments. To (1) continue a long-time rotation and fertilizer experiment begun in 1921; and (2) study effects on the soil of long-time rotations and fertilizer treatments.
Agron. 125

Ark. Rotation and Fertilizer Experiments for Cotton Production on Heavy Delta Soils. To study various crop rotations and fertilizer treatments for cotton production on heavy-textured soils (Sharkey series) of Eastern Arkansas.
Agron. 365

Ga. Effect of Various Rotations on Yield of Crops. To compare yield of annual crops in a 3-year rotation following three years of Coastal Bermuda grass and crimson clover, three years of soybeans and crimson clover, three years of alfalfa, and three years of annual crops.
Agron. 24

Ga. An Evaluation of the Practical and Economical Aspects of Sod-Corn Rotations in North Georgia. To learn (1) if an economical and practical rotation superior to continuous corn can be developed in mountain area; (2) value of rotation on soil productivity and fertilizer utilization; (3) uptake of N, P, and K in forage as influenced by fertilization and duration of sod; and (4) fertilizer treatment needed to maintain or increase soil productivity and to correlate crop yields and N, P and K uptake by forage, with chemical soil tests.
Soils, Fert., Field Crops, 36

Idaho Determination of Causes of Poor Growth of Legumes in Northern Idaho. To (1) find reason for poor growth of legumes in crop rotations used in Northern Idaho; and (2) attempt to increase growth of legumes by use of soil treatments, use of different strains of inoculation, or by combinations of the two methods.
Bact., Agr. Chem., Agron. 245

Ill. A Study of the Adoption of a Recommended Soil Fertility and Crop Rotation Program in Piatt County, Illinois. To describe and analyze processes by which recommended farm practices become known to farm people, become accepted as possible or feasible for their use, are adopted, and finally are accepted as part of the culture generally used by farm people in an area.
Agr. Econ. 05-395 Coop. FES

Ind. *The Effect of the Proportion of Sod Crops in the Rotation on the Establishment of Soil Productivity Levels.* To determine the effect other than nutrient effect of grass and legume crops in the rotation on promoting soil productivity and to determine as closely as possible the cause of these effects.
Agron. 655

Kans. *Crop Rotations and Soil Productivity.* (1) Learn effect of legumes on cereal crop growth; and (2) apportion legume's effect to this crop's N fixing. Rotations are: continuous wheat; continuous sorghum; sorghum, wheat, wheat; alfalfa (2 yrs.), sorghum, wheat, wheat; bromegrass (2 yrs.), sorghum, wheat, wheat.
Agron. 504

Ky. *The Effect of Cropping and Soil Management Practices on Yield and Quality of Burley Tobacco.* To determine effect of cropping, fertilizing, manuring, liming, etc. on yield and quality of the cured leaf of burley.
Agron. 153 Coop. USDA

Minn. *Cropping Systems Based on Grassland Crops.* To (1) determine how much of increased yield of crops which follow legume-grass sod is due to N contributed by the legume and how much by the sod per se; (2) determine how long beneficial effects of sod last after it is plowed; and (3) evaluate new concepts of crop management such as growing green manures between widely spaced corn rows as compared with conventional systems.
Agron., Plant Genet., Soils 1321

Mo. *Experiments in Crop Sequences. a. Continuous Cropping vs Crops in Sequences of Various Length.* To produce corn, small grains, and forages on experimental plots where these crops are grown continuously and in various combinations; and (2) study established plots to determine crop production and soil effect.
Soils 117-a

Mo. *Experiments in Crop Sequences. b. Effect of Soil Treatments in Various Cropping Systems.* To determine effects of different soil treatments in continuous and rotation cropping sequences giving attention to both yield and quality.
Soils 117-b

Mo. *Experiments in Crop Sequences. c. Value of Different Legumes in Cropping Systems.* To (1) determine yields of grain crops when they follow different legumes on soils of varied nutrient level; and (2) study effect of these different legumes on soil nutrient levels.
Soils 117-c

Nebr.	Crop Rotations. To determine performance of various standard farm crops grown in rotation with and without legumes and barnyard manure and the comparative rotation value of sweetclover, red clover, alfalfa, and soybeans. Agron. 22
N. Y. (Cornell)	An Investigation of Methods for Improving the Quality and Economy of Production of Feed Crops for the Principal Soil and Climatic Regions of New York State. V. Crop Rotations for Dairy Farms. To (1) compare as to economy of feed production three main types of rotations: those producing primarily roughage, those producing the balance of grain to roughage needed for economical milk production, and those producing primarily grain; (2) determine proper time to fertilize, kind of fertilizer, and amount to use when fertilizing a rotation; and (3) determine value of manure in various cropping systems. Agron. 46-V
N. C.	The Productivity of Peanut Soils as Influenced by Crop Sequence and Management Practices. To (1) isolate factors responsible for marked reduction in productivity of soils which are planted frequently to peanuts; and (2) evaluate different crop rotations and use of various fertilization and management practices upon production of peanuts and other crops in the rotation. Soils 109
N. Dak.	Soil Fertility, Crop Rotation, and Sweet Clover Management Trials. To (1) compare various cropping systems and influence of manure produced by each; (2) study values of superphosphate, ground limestone, and sulfate of potash in livestock and grain farming systems; (3) compare steamed bone meal, ground raw rock phosphate and superphosphate as carriers of phosphorus; and (4) manage sweet clover in a rotation in preparing the land for wheat. Agron., Soils 6-4
Ohio	Interrelationships of Crop Rotations, Organic Matter Input, Soil Structural Conditions and the Internal Drainage Characteristics of Soils. To (1) determine effectiveness of specific crops and rotations in modifying soil structural conditions; (2) study the development and yield of crops in relation to time and extent of drainage; and (3) evaluate soil physical properties of drained land under different levels of management to develop criteria for determining size, depth and spacing of drains. Agron., Agr. Engin. 64 Coop. SCS

Ohio *Development of Cropping Systems for Soils in Which Chronic Plasticity Imposes Restrictions on Crop Production.* To (1) learn nature of limitations to crop production on soils having heavy texture and poor drainage; and (2) develop cropping systems for soils on which cropping is restricted by wetness and texture and systems that will circumvent necessity of working when moisture content is unfavorable and that will ameliorate soil physical effects on crop performance.
Agron. 141-1

Pa. *Soil and Crop Management Systems for Permanently Productive Agriculture.* To measure (1) physical returns of selected systems of management representing optimum, average, and deficient combinations of treatments; (2) cumulative effects of selected systems on physical, chemical, and biological properties of soil profile; and (3) root-soil relationships of crop plants utilized in selected systems thru soil profile.
Agron. 1281

R. I. *The Effect of Certain Crops on Succeeding Crops of Potatoes.* To determine what factors are responsible for the beneficial or deleterious effects of red clover, timothy and red top on a succeeding crop of potatoes.
Agron., Agr. Chem. 207

Texas *Utilization of Legumes for Soil Improvement.* To develop more practical systems of management of legumes for soil improvement by evaluating (1) Madrid sweet clover, alfalfa, Hubam, *Melilotus indica* and Dixie Wonder peas as soil building crops to precede corn; and (2) soil-building value of new rapid growing winter legumes for cotton and residual effect on corn yields.
Agron. 513

Texas *Influence of Cropping Systems on Crop Yields, Soil Improvement, and Conservation.* To determine (1) effect of cropping systems on soil productivity in major farming areas; (2) information which can be used to formulate good cropping systems for each major problem area; (3) a procedure whereby a soil productivity balance can be arrived at for given soil and land conditions; (4) effect of good cropping systems on soil structure and air-water relationship; and (5) combined effects of all known positive practices on crop production for a number of soil and land conditions in Texas.
Agron. (Substation 5) 719 Coop. ARS

Va. Comparison of Several Rotations with Varying Rates of Fertilization. To study effect of several legumes on succeeding crops in rotation; (2) compare feed production from several rotations and alfalfa continuously; (3) compare effect of two rates of fertilization on each rotation; (4) study effect of several rotations on certain physical and chemical properties of soil; and (5) study effect of several rotations and two fertility levels on incidence of disease.

Path., Physiol., Agron. 86011

W. Va. Crop Rotation Experiments. To determine (1) efficiency of various cropping systems in production of feed per acre; (2) effect of soil fertility level on efficiency of production of various cropping systems; and (3) effect of cropping system on physical, chemical, and biological properties of soil.

Agron. Genet., Agr. Econ. 43

Wyo. The Effect of Cropping Practices on Yield and Some Physical and Chemical Properties of the Soil. To (1) determine effect of continuous cropping and alternate crop and fallow on yield of winter wheat, spring wheat, oats, barley and corn; (2) determine effect of kind of crop and continuous vs. alternate crop and fallow on certain physical and chemical properties of soil; (3) compare effect of crested wheat, alfalfa, and a mixture of them in maintaining soil N and organic matter content and yield in 12 year rotations with corn, spring wheat and oats; (4) compare effect of manure vs. no manure in continuous cultivation on N, organic matter content, and soil physical properties; and (5) compare effect of continuous cultivated rotations vs. sod crops in rotation on yield and chemical and physical soil properties.

Agron., Chem. 539

B. Tillage

Ariz. The Influence of Bed Shape, Planting and Irrigation Practices on the Germination and Yield of Row-Crops on Saline Soil. To study influence of bed shape, bed slope, planting and irrigation practices on germination, stand and yield of row-crops on saline and saline-alkali soils. Modify shape of seed-beds to change tendency of salts to accumulate and the soils to crust or pack over the seed. Sloping beds are to have north and south exposures to permit an evaluation of soil temperature effect on stand and yield. Also study mulched beds and basin or furrow plantings.

Agr. Chem., Soils, Agron., Range Mgt. 409 Coop. USDA

Ga. The Effect of Deep Tillage and Deep Placement of Fertilizer on Subsequent Crop Yields, Moisture Conservation, and Soil Structure. Learn effect of deep tillage and deep placement of fertilizer on plant growth, root growth, soil moisture, bulk density, and power consumption required for primary tillage.
Agr. Engin., Agron. 311 Coop. ARS

Ill. Improvement of Power, Machinery and Labor Efficiency in Farm Operations. (1) Learn effect of tillage on compacted and non-compacted soils as reflected by corn yield, power requirement for plowing, and physical characteristics of soil; relation between soil compaction, corn yield, power need for tillage, and physical characteristics of soil; study means for improving tilth of compacted soils; (2) learn flow characteristics of various fertilizer solutions under gravity pressure and develop improved, simplified equipment for application of fertilizers; and (3) learn factors affecting penetration of soils by high-pressure liquid jets and apply knowledge in developing equipment for injecting anhydrous ammonia.
Agr. Engin. 10-333

Ill. The Effect of Tillage, Planting Method, and Placement of Fertilizer on the Production and Maintenance of Forage Crops. To (1) determine effect of deep tillage and placement of fertilizer on grain and forage yields and maintenance of stand composition; (2) determine effect of various methods of seedbed preparation on grain and forage yields and stand composition; (3) study root development under above treatments; and (4) study effect of deep tillage and methods of seedbed preparation on water storage capacity of soil, availability of soil moisture and on soil and water losses.
Agron. (Dixon Springs) 40-326

Ind. The Management of Crop Residues for Improvement and Maintenance of Soil Productivity. To (1) determine interrelationships between specific soil properties that are affected by crop residue management; (2) devise mulch tillage methods for corn, soybeans, and small grains for situations in Indiana; (3) determine limiting factors of crop production under mulch tillage; and (4) test existing implements or devise implements for effective mulch tillage.
Agron. 802

Mich. The Use of Several Tillage Methods for the Preparation of Seed Beds for General Agricultural Crops. To determine (1) the effect of various methods of seed bed preparation on crops and on the physical properties of the soil; and (2) time, power, and labor requirements of these methods.
Soil Sci. 7

Nebr. *Tillage Practice in the Central Great Plains in Relation to Erosion and Weed Control, Soil Moisture and Crop Response to Fertilizers.* Learn (1) relative efficiency of stubble mulch vs. clean tilled fallow for control of wind and water erosion; (2) most practical and effective methods of conducting stubble mulch farming; (3) most practical methods of controlling downy bromegrass in wheatfields of Western Nebraska; (4) effect of tillage method on soil moisture accumulation; and (5) relative effect of fertilizer on yields on stubble mulch and clean tilled fallow under limited rainfall conditions.
Agron. 543 Coop. ARS

N. H. *The Influence of Deep Tillage and Fertilizer Placement on Soil Structure and Crop Production on Soils with Compact Subsoils.* To determine to what extent structural improvement of compact subsoils can be accomplished and maintained and the extent to which such improvement may result in deeper rooting of perennial crops and greater use of nutrient and moisture reserves of soil profile.
Agron. 83 (NE-11)

N. J. *Tillage Effects in Maintaining Soil Structure.* To find new methods and possibilities of preparing seedbeds, and improving tillage practices.
Soils 632 Coop. ARS

Ohio *Tillage Practice in Relation to Soil Tilth and Crop Response.* To (1) evaluate quantitatively the soil physical conditions produced by different tillage methods at time of tillage and to determine their longevity; (2) determine to what extent and why crop growth and yield vary with different tillage methods; and (3) obtain information on power and labor for various tillage practices used.
Agr. Engin., Agron. 38

Pa. *The Agronomic Aspects of Deep Tillage on Pennsylvania Soils.* To study (1) effect of deep tillage on elimination of "plow pans;" (2) evaluate effects of deep tillage on physical properties of soils with compact subsoils and soils with shale substrate; and (3) effect of deep placement of fertilizers and soil amendments on penetration of plant roots, crop yields, and on physical properties of deep tilled subsoils.
Agron. 1260-A Coop. SCS, U.S. Penitentiary Res., Lewisburg, Pa.

Pa. The Agricultural Engineering Aspects of Deep Tillage of Pennsylvania Soils. (1) Study and evaluate applicability of various types of deep tillage equipment and equipment for deep placement of lime, fertilizers, and other chemicals; and (2) learn draft requirements and vertical soil resistance for subsoiling various soils at depth of 12, 18, and 24" and spacing of 1, 2, 3 and 4' widths.

Agr. Engin. 1260-B Coop. SCS

Tenn. The Effects of Subsoiling, in Addition to Ordinary Plowing and Disking, on Crop Yields and Moisture and Organic Matter Content of the Soil. To compare effects of following tillage treatments on yields of crops in rotation; (1) ordinary turning; (2) subsoiling and turning; and (3) subsoiling and deep disking and determine influence of tillage treatments on soil moisture levels and organic matter content.

Agron. 41

Va. Tillage and Machinery Problems in the Application of Soil and Water Conservation Practices. To develop suitable tillage practices for the effective application of mulch culture principles in the various geographical areas of the state, including determination of the machinery problems involved, the construction and testing of experimental models and the modification of existing equipment. To study the operating characteristics of existing farm machines in connection with the application of conventional soil and water conservation practices, and to devise where possible, ways and means of overcoming critical deficiencies in their present operating capabilities.

Agr. Engin., Agron. 86002 Coop ARS, SCS

Wyo. A Study of Methods of Summer Fallowing Winter Wheat Land. Learn (1) effect of mechanical and chemical fallow systems and their combinations on soil fertility, crop yield, and weed control; (2) influence of mechanical and chemical fallow systems and their combinations on water intake rates; and (3) compare costs of various summer fallow operations.

Agron. 582 (W-32) Coop. ARS

C. Mulching and Organic Matter Maintenance

Alaska

Effect of Mulching on Survival, Productivity, and Weed Control Practices of Strawberry. To determine (1) effect of mulching and weed control practices on overwintering and productivity of strawberries; (2) if good commercial varieties can be grown successfully when cultured in a manner similar to that used by commercial Statewide growers; and (3) to provide a means of developing strawberry industry with existing varieties until such time as a better variety is released from the hybridizing program.
Hort. 11

Conn.

Green Manure Crops for the Improvement and Maintenance of Physical Properties of Vegetable Soils. To study effect of various green manure crops on the improvement and maintenance of soil physical properties as related to increased vegetable production.
Soils 722

Del.

Green Manuring Practices and Their Effect on Corn Yields. To learn (1) effectiveness of different green manuring methods for increasing corn yields; and (2) rate of breakdown of various plant residues and nature of soil organic matter produced.
Agron. 35A

Ga.

The Effect of Different Plant Spacings, Mulching with Sawdust, and Irrigation Upon the Yield and Market Quality of Strawberries. To determine (1) most satisfactory spacing of strawberries to produce high yields of good quality fruit; (2) effect of sawdust mulch on yield of strawberries irrigated and non-irrigated; and (3) effect of irrigation on yield and quality of fruit and on livability of strawberry plants.
Hort. 90

Ind.

The Effect of Vertical Mulching on Certain Soil Factors. Learn effects of vertical mulching on certain soil factors influencing productivity, and expected to be modified significantly by vertical mulching. From work with large watersheds and under artificial rainfall on small plots, learn effect of vertical mulching on rate of water penetration. Study mode of diffusion of water from the channel into the surrounding soil by laboratory models and small field blocks.
Agron. Agr. Engin. 974

Ky. Effect of Various Mulch Materials on Latham Red Raspberries. To determine effect of several mulch materials on Latham raspberries with particular reference to suitability of materials and amount needed, fruiting capacity, plant longevity, disease resistance, weed control, soil moisture retention, and soil temperatures.
Hort. 554

Miss. Mulch Farming Requirements. To study (1) equipment needs and adapt or design equipment satisfactory for producing crops in mulch; (2) crops, spacing and fertilization needs of said crops for economical production by mulch methods; and (3) additional water requirements for crops, if any, due to mulch type farming.
Agr. Engin. HB-2

Miss. A Study of the Influence of Small Grains as Winter Green Manure Crops on the Growth, Quality, and Yield of Vegetable Crops. (1) Learn value of small grains as winter green manure crops on: yields and quality of vegetables, increasing organic matter, losses of plant food by leaching, occurrence of weeds and non-desirable grasses; (2) compare results obtained from plots planted to small grain to ones using animal manure, and to bare plots; and (3) learn influence of small grains on amount, kind, and time of application of commercial fertilizers for maximum yields.
Hort. HZ-3

Nebr. Maintenance of Organic Matter and its Effect on the Physical Properties of Nebraska Soils. To determine (1) effects of cropping systems and management practices on carbon and nitrogen contents of soil; (2) relationships of soil organic matter to the physical properties of soil; (3) role of clay minerals in maintaining soil organic matter and in improvement of soil structure; and (4) importance of aggregate size to plant growth, especially in use of nutrients and water by plants.
Agron. 292 (NC-17) Coop. ARS

Nebr. Value of Perennial Grasses and Legumes for the Maintenance of Soil Organic Matter and for the Improvement of the Physical Properties of Nebraska Soils. To study (1) maintenance of N and organic matter of soil as influenced by perennial grasses and legumes; (2) determine effect of perennial grasses and legumes on soil structure; (3) determine relative stability of structure imparted to soil by various grasses and legumes; and (4) study effects of commercial N on growth of perennial grasses and legumes and consequently their effects on physical properties of soil and maintenance of N.
Agron. 311 (NC-17) Coop. ARS

Nebr. Use of Legumes with Commercial Fertilizers to Maintain Organic Matter and Fertility in Nebraska Soils. To determine (1) direct influence of commercial fertilizer and lime applications on yield and quality of legumes and indirect effect of these applications on organic matter and fertility of the soil; and (2) satisfactory methods and desirable stages of growth for incorporating legume residues in soil to maintain adequate supplies of available N.

Agron. 332 (NC-16) Coop. ARS, SCS

Nev. Green Manure Crops to Increase Fertility and Improve Structure of Southern Nevada Soils. Evaluate suitability of plant species for a green manure crop in Southeastern Nevada; learn best management practices as: time of planting, rate of seeding, seed placement, irrigation needed, time and method of turning under green manure.

Agron., Soils, Range Mgt. 16

Oreg. Sawdust and Other Wood Wastes as Mulches or Soil Amendments. To determine (1) growth response of both annual and perennial horticultural crops to production under various organic mulches and soils amendments, rates of supplemental commercial fertilizers required for normal plant growth, and the value of these mulches in facilitating cultural operations; (2) by analysis the soluble nutrients value for conserving soil moisture and effect on porosity and granulation of the soil, and the value as a source of organic matter and humus renewal; and (3) rate and extent of decomposition of mulches and their effects on microbiological activities in the soil.

Hort., Soils, Bact. 45

S.Dak. The Effects of Mineral Fertilizers, Crop Residues, Legumes, and Grasses, on the Fertility and Physical Properties of Soils. To study effects of (1) fertilizer application in row and hill placement on yields; (2) crop residues for maintenance of soil fertility and for soil and water conservation when incorporated with the soil by plowing and by subsurface tillage leaving crop residues on the surface; (3) fertilizer applications on crop yields when applied with crop residues; (4) clover and grass rotations with respect to maintenance of soil organic matter and fertility; (5) tillage, crop residues, manure, grasses, and legume on the physical properties of the soil; and (6) various soil treatments on yields.

Agron. 46

Tenn. Conservation of Organic Matter in the Soil as Affected by Degree of Neutralization (Liming). Learn (1) feasibility of building up organic matter content of soils of low-fertility thru incorporations of plant material, as affected by type of plant material --leguminous and non-leguminous, degree of liming: none, 60 percent, and 100 percent Ca-saturation; and (2) effect of additive organic matter on mobilizing of N, Ca, Mg, and K and effect of various treatment combinations upon mobility or translocation of organic matter into lower zones and into rainwater leachings.

Agron. Chem., Soils 35

D. Orchards, Including Fertilization

Ariz. Factors Affecting the Production of Pecans in Arizona. Learn (1) soil moisture and salinity in relation to irrigation requirements; and (2) nutritional requirements of pecan trees in Arizona.

Hort. 398 Coop. ARS

Calif. Studies in Orchard Soil Fertility. Points to be investigated include: (1) soil management practices such as (a) covercrop block, under differential treatment for 25 years, (b) pear block for data on cultivation vs. non-leguminous sod, and (c) "non-cultivation" plots now under way as cooperative trials in commercial orchards; (2) use of commercial fertilizers to provide suitable nutritional conditions; and (3) adaptation of means of evaluating effect of treatment on soil structure.

Pomol. 768

Calif. A Study of Citrus Orchard Soils with Special Reference to the Possible Deleterious Effect of Past Fertilizational and Cultural Practices. To investigate the chemical, physical, and biological characteristics of citrus orchard soils in which yields, quality and sizes are excellent in comparison with those in problem orchards; and the effects of various fertilizational and cultural practices on the chemical, physical and biological characteristics of orchard soils.

Plant Nutr., Soils 1188

Colo. The Effect of Timing, Method of Application and Source of Nitrogen on Delicious Apples. Learn effect of timing, method of application and source of N on chemical composition, growth, color and yield of Delicious apples in Western Colorado.

Hort. Agron. 43

Del. Apple Soil Management. To determine the best soil management practices for apple orchards in Southern Delaware.
Hort. 50-H

Ind. The Effect of Different Systems of Soil Management and Fertilization Upon the Growth and Productivity of Fruit Trees. (1) Learn what methods can be used to improve physical condition of soils to be used as orchards; (2) study methods of counteracting ill effects of necessary orchard management practices on soil structure; (3) learn what effects created high levels of soil fertility may have on growth and fruitfulness of trees; and (4) develop a working correlation between plant composition and analysis of soil and fertilizer application.
Hort. 946

Mass. The Nutrition of Apple Trees. To (1) increase knowledge of the effect of different levels of nitrogen on growth, yield, color and keeping quality of fruit as maintained by soil applications of nitrogen fertilizer, mulching materials and complete fertilizers; (2) find out effect of different levels of nitrogen on chemical composition of foliage and intake of mineral elements into the tree in relation to availability in the soil; (3) determine if application of elements to soil other than nitrogen are necessary to maintain maximum growth and yield; and (4) determine level of nitrogen which will produce highly colored apples of maximum storage life without losing yield and tree vigor.
Hort. 96

Miss. Peach Fertilization and Pruning. Study effects of N, P and K fertilizers at 3 levels of pruning on tree growth, yield, and quality of fruit of the peach.
Hort. HK-25

Mo. Nutrition of Fruit Plants. (1) Study correlations between available essential nutrient element content of soil, content of elements in plant tissues and performance of crop plant in established plantings for major fruit growing regions; learn (2) optimum levels of major and minor nutritive elements for fruit plants under State conditions; (3) most practical methods for indicating nutritive need of plants; (4) develop more satisfactory methods of applying nutrients to plants; (5) study relation between certain physical properties of soil and availability of mineral elements of fruit plants; and (6) absorption and use of nutrients by plants during high and low levels of available moisture.
Hort. 4

N. C. The Effects of Cultural Practices and Supplemental Irrigation Upon Soil Properties and Orchard Performance Under Sandhill Conditions. To investigate interactions between soil management practice and N fertilization and water supply as to effect upon vegetative and fruiting characteristics of peach, tree survival, and soil properties; and (2) evaluate supplemental irrigation as it affects tree growth and performance, and N requirements.
Soils H-116

N.C. Soil Factors Affecting the Survival of Young Peach Trees Planted on the Sites of Old Orchards. To determine (1) role of various soil factors in failure of re-planted orchards with a view to developing corrective measures; and (2) relationship of certain nutritional conditions to winter hardiness of peach trees.
Agron., Soils H-117

Ohio The Response of the Peach to Different Cultural Practices, and Rates of Nitrogen Fertilization as Indicated by Growth, Yield, Quality of Fruit, and Mineral Composition of the Foliage. To determine (1) systems of culture best adapted to establishment of peach orchards on old orchard sites; (2) effect of mulch upon nutritional status of tree with particular reference to fruit quality; (3) relation of nutrient content of foliage to quantity and quality of fruit produced; and (4) practicability of rapid methods of determining soluble nutrient content of leaf tissue as guide for fertilizer recommendations for peach.
Hort. 21

Ohio A Study of the Nutrient Status of Ohio Vineyards and of the Effect of Various Pruning, Soil Management and Fertilization Practices on the Growth, Yield and Quality of Grapes. To (1) survey representative Ohio vineyards to find essential nutrient element status of commercially important varieties as indicated by foliar analysis; (2) investigate severity of pruning in order to obtain information upon which specific recommendations for grower pruning practice may be based; and (3) determine influence of various soil management and fertilizer practices on yield and quality of Concord and Delaware grapes.
Hort. 40

Pa. Cultural Practices and Fertilization of Tree Fruits. D. Montmorency Sour Cherry Fertilizer and Soil Management Study. To determine influence of two systems of soil management and various fertilizer applications in improving yield in a commercial planting of sour cherries.
Hort. Agron. 909-D

Pa. Cultural Practices and Fertilization of Tree Fruits. F. The Relationship Between Sweet Cherries on Different Rootstocks Under Two Different Cultural Systems. To determine survival and productivity of two sweet cherry varieties on commercial Mazzard and Mahaleb rootstocks grown under two systems of soil management, Ladino clover sod and cultivation followed by ryegrass.
Hort., Agron. 909-F

Pa. The Effects of Differential Fertilization on the Performance and Foliar Composition of Sour Cherry Trees. Learn probable correlation between foliar composition and performance of sour cherry trees subjected to differential fertilization with three levels of N, P, and K applied in all possible combinations.
Hort., Soils 1267

R. I. Cultural and Fertilization Practices for Tree Fruits. To (1) determine value of mulch materials in culture of tree fruits when compared with clean cultivation and sod; (2) study use of supplementary N with sod and mulch; and (3) investigate foliar fertilization as a substitute for, or supplement to, ground fertilizer applications.
Hort. 503

S. C. The Effect of Minor Elements and Irrigation on Peach Trees in the Sandhills of South Carolina. To determine the effect of (1) Fe, Mn, Zn, B and Mg on the growth and yield of peach trees; and (2) irrigation on the growth and yield of peach trees.
Hort., Agron. 63

(For more information on research in this category, see I. FERTILITY AND FERTILIZERS.)

E. Pasture and Forage, Including Fertilization

Ala. Effects of Applied Lime and Fertilizers and Soil Fertility Level on the Production of Pasture and Forage Crops. (1) Learn best rates, combinations and frequencies of application of lime and mineral fertilizers for maintaining productive stands of pasture and other forage crops; (2) relate yield responses on various soils to level of available nutrients as determined by lab analysis; (3) learn desirability of applying N to newly seeded and established grass-legume pastures and learn effects of practice on botanical composition of pasture sward; and (4) evaluate effects of irrigation, N applications and grazing management on mineral fertilizer needs of pasture and forage crops and on level of soil fertility.
Agron., Soils 406

Colo. *Improvement of High Altitude Irrigated Meadows.* To determine (1) optimum moisture-plant relations for high yield of good quality hay and pasture at elevations over 7000 feet; (2) best fertilizer types and combinations and most effective rates and methods of application of meadow plant species in these meadow areas; (3) most suitable species, strains and mixtures of plants for hay meadows and irrigated pastures at high altitudes; (4) better methods to establish stands of desirable species in old meadows or on new lands; (5) best time of harvest and best management practices to give high yield and quality of hay and forage on mountain meadows; and (6) nutrient value and productive value of hay and forage produced in these experiments.

Agron. 147 Coop. ARS

Del. *Differential Irrigation, Nitrogen Fertilization and the Top and Root Growth of Several Forage Species.* Determine influence of differential irrigation and N fertilization on top and root systems of alfalfa, ladino clover, and birdsfoot trefoil, alone and in association with orchardgrass by placing emphasis on: effect of depth of wetting of profile on distribution of root systems; interactions that may exist between depth of wetting and species in relation to root and shoot development; influence of level of watering on species response to N applications; relationship between level of watering, N fertilization, and consumptive use of water by several forage species; seasonal effect of differential watering and N fertilization on carbohydrate reserves in storage organs of each species.

Agron., Agr. Engin., Agr. Chem. 22A Coop. USDA

Fla. *The Maintenance of Soil Fertility Under Permanent Pasture.* To study (1) effects of different soil types and various management practices on yields, composition of forage and animal response; and (2) effect of these practices on physical and chemical characteristics of soil and on maintenance of soil fertility.

Soils 404

Ga. *Fertilizer Requirements of Pasture Plants Grown on the Piedmont Soils of Georgia.* Learn (1) effect of rates and combinations of N, P and K, secondary and minor elements on forage and seed production and chemical composition of various pasture plants and combinations of plants grown on Piedmont soils; and (2) compatibility of various grasses and legumes and the change in botanical composition of pasture swards under different fertilizer treatments.

Agron. Chem. 40

Ill.

Forage Crop and Pasture Management Studies. To study (1) influence of height and frequency of cutting and intensity of grazing on longevity and productivity of forage crops; (2) effect of individual species on productivity and other characteristics of forage crops and pasture mixtures; and (3) response of alfalfa and red clover to various P carriers at different soil pH levels.
Agron., Soils 15-380

Ill.

The Effect of Mowing and Fertilization on Pasture Vegetation. To (1) study effect of mowing and fertilization, under grazing conditions, on productivity of desirable vegetation, and prevalence and control of weeds; (2) study influence of these treatments on botanical composition, maintenance, accession, and eradication of plant species; (3) study chemical compositions of species and forage samples where warranted; and (4) observe and record animal preference, if any, for vegetation from various treated plots.
Agron. (Dixon Springs) 40-331

Maine

Fertilization and Other Management Practices Affecting Yield and Persistence of Forage Legumes and Grasses. To (1) determine most desirable liming, fertilization, and other management practices for production and persistence of forage crops on representative Maine soils; (2) compare yield, quality, and persistence of pure stands of grasses vs. legume-grass associations under different management practices; and (3) correlate fertility responses with soil test results.
Agron. 32

Md.

Response of Orchardgrass to Various Rates and Ratios of Potassium and Nitrogen Fertilization. Study (1) interrelationship of K and N in nutrition of orchardgrass; (2) effect of K and N on yield, longevity of stand and chemical composition of orchardgrass; and (3) learn what K contents in harvested forage are critical for maximum yield and stand persistence.
Agron. 0-59

Md.

The Effect of Various Rates and Frequencies of Potassium Applications on Yield, Persistence and Chemical Composition of Alfalfa and Alfalfa-Orchardgrass. (1) Learn most efficient rate and time of applying K to alfalfa and alfalfa-orchardgrass; (2) study how alfalfa and alfalfa-orchardgrass stands differ in their K requirements; and (3) learn what K contents in harvested forage are critical for maximum yield and stand persistence.
Agron. 0-60

Miss. Pasture and Forage Production Investigations. e. Comparison of Colloidal and Rock Phosphates with Superphosphate for the Establishment and Maintenance of a Legume and a Grass-Legume Mixture. To determine value of phosphorus sources for the establishment and maintenance of pastures, as to total forage production, distribution of production during growing season, botanical composition of sward, and chemical composition of forage.
Agron. HC-14

Miss. Pasture and Forage Production Investigations. d. Response of Fescue and Fescue-Ladino Clover to Levels of Potash Fertilization. To determine (1) optimum level of potash for production of fescue and fescue-ladino clover; (2) level of potassium in plant tissue required for optimum physiological functioning; (3) range of potassium in plant tissue which might be termed "luxury consumption"; and (4) level of potassium in plant above which a depression of physiological functioning might occur.
Agron. HC-15

Miss. Production, Fertilization, Management and Utilization of Johnson Grass. To develop sound practices for production of Johnson grass: (1) Rates of seeding and row spacing will be studied; (2) Red clover, alfalfa, creeping alfalfa, rough pea, climax lespedeza and hairy vetch will be established in Johnson grass; (3) oats, wheat, barley, rye and ryegrass will be seeded in Johnson grass; (4) root reserves and rhizomes will be analyzed for carbohydrate content and weight will be randomly learned; and (5) ammonium nitrate will be applied on replicated plots.
Agron. HU-1

N.C. The Fertility Requirements of Adapted Forage Plants. To (1) determine response of important forage plants of the area to rates and method of application of major and minor nutrients; and (2) study effect of such treatments and soil properties upon nutrient uptake, chemical composition, and nutritive value of the plants.
Agron., Soils 113

Oreg. Soil Fertility Problems Affecting the Production of Forage Crops in the Coastal Area of Oregon. (1) Learn: short time effects of lime and individual nutrients alone and in combination, on yield, mineral composition, botanical composition, and seasonal production of forage crops grown in coastal area; optimum rate of application of several nutrients that must be added to produce the highest or most economical yields of forage; residual effects of applications of lime and plant nutrients on soil and fate of nutrients added to soil; and (2) provide: data needed for calibration of soil and plant tissue tests including data on response of forage crops to fertilizer and lime; physical data on crop response needed for an economic analyses of use of fertilizers and lime.

Soils 255

Pa. Maintenance Fertilization of Grasslands in Pennsylvania. To (1) study effect of different amounts and ratios of fertilizer on dry matter yields and maintenance of legumes in various grass-legume mixtures; (2) correlate soil tests and fertilizer applications with yields; (3) study effect of fertilizer nutrients on plant uptake and mineral content; (4) study effect of one element on plant uptake of it and other elements by grasses and legumes; and (5) study improvement in soils thru addition of nutrients applied as top dressings.

Agron. 1236-A

S.C. Irrigation of Coastal Bermuda Grass. (1) Learn difference in yields between irrigated and unirrigated Coastal Bermuda grass; and (2) study effect of N applications on production and value of Coastal Bermuda grass.

Dairy Husb., Chem. 106 (S-12)

Tenn. Pasture Fertilization and Forage Quality Studies. To (1) determine P and K requirements of permanent pastures on representative soil series in the state; (2) determine if a large initial fertilizer application or smaller annual applications are the better practice; (3) study effect of N on yield and species composition of pastures; and (4) study effect of fertilization on chemical composition of forage.

Agron. 40 Coop. TVA

Texas Growth and Management Studies with Selected Forage Species. Obtain information on growth phenomena (above and below-ground development) of selected grasses and legumes over their life history under Texas climatic conditions; study effect of management treatments (e.g., harvest stage, date, frequency and height; cultivation; nutrient level and placement; and irrigation) on growth phenomena of plants.

Agron., Soils 721 (S-12) Coop. ARS

W. Va. The Influence of Fertility and Management on Several Ladino Clover-Grass Mixtures. To (1) determine yield of Ladino clover grown alone and in association with bromegrass, Reed canary grass, orchard grass, and Kentucky 31 fescue; (2) determine effect of various fertilizer applications on stand, yield, botanical and chemical composition of various combinations of Ladino clover-grass mixtures; (3) determine effect of management on stand, yield, botanical and chemical composition of mixtures; (4) evaluate compatability of mixtures; and (5) study longevity of stand as influenced by fertility and management.
Agron., Genet. 19

(For more information on research in this category, see I. FERTILITY and FERTILIZERS.)

F. Reclamation and Miscellaneous Studies

Ark. The Influence of Cultural Practices and Environment on the Production and Behavior of Strawberries. To (1) study relation of edaphic and climatic conditions to fruit production, quality, and characteristics, and plant maintenance, production and behavior; and (2) determine effect of cultural practices, such as rotations, green manuring, mulching, irrigation, fertilizing, and spacing on plant behavior and performance.
Hort. , For. 284

Colo. The Effect of Alfalfa, Plant Nutrients, and Moisture Level on Crop Production Under Irrigation in Colorado. To learn (1) effects of alfalfa and plant nutrients on the yield and quality of crops grown in a rotation and on the chemical and physical characteristics of the soil; and (2) effects of moisture level, plant nutrients, and plant population on the quality and yield of crops.
Agron. 11

Colo. Improvement, Management, and Classification of Poorly Drained Soils of the San Luis Valley of Colorado. To (1) determine optimum level or levels of water table for efficient irrigation and drainage; (2) study efficiency of methods of controlling salinity and base exchange, including irrigation, drainage, soil amendments and leaching; (3) determine crop management practices contributing to soil improvement and more crop production; (4) study effects of irrigating with drainage water, with and without amendments, on salinity, alkali, soil structure, and plant growth; and (5) improve techniques and standards for classifying poorly drained, saline and alkali soils of San Luis Valley.
Agron. 13

Colo. Soil Fertility, Salinity, and Moisture in Relation to Crop Production in the Upper Colorado River Basin. To (1) determine methods for improving saline and alkali soils through the use of different systems of water management, amendments, cultural and cropping practices; (2) evaluate the physical, chemical, and mineralogical characteristics of existing and potential saline and alkali soils under different moisture regimes which are of significance to diagnosis for reclamation; (3) study fertility status of soils and determine methods and principle of efficient fertilization under different systems of cropping and water management; (4) evaluate the effects of alfalfa produced under different moisture regimes on the accumulation of organic matter and nitrogen, and on the productivity of the soil; (5) determine the optimum moisture conditions for crop production and the relation of moisture status to salt accumulation and nutrient uptake; and (6) study interrelations between the various fertilization practices, soil moisture, salinity, cultural methods, nutrient uptake, maximum and economic yield of the several crops in a rotation.

Agron. Engin. 224 (W-29) Coop. ARS

Del. Soil Fertilization and Cultural Practices in Soybeans. Learn (1) most effective time of applying different ratios of fertilizers; (2) yield response of soybeans to supplemental N as affected by soil acidity; and (3) cultural practices most suitable for new and improved varieties being recommended for Delaware.

Agron. 12-A

Ill. Measurement of the Productivity of Illinois Soil Types Under Specified Systems of Management. To determine yields of important crops which are obtained from Illinois soil types under different systems of management and environmental conditions.

Agron. Agr. Econ. 15-372

Ill. Forest Nursery Soil Management. (1) Improve quality of planting stock produced in State Forest Tree Nurseries by developing better techniques of nursery soil management; (2) learn what soil or management deficiencies limit quality of stock now being produced; and (3) correlate foliar nutrient content with field survival of stock graded by conventional methods, fertilizer practices, mulches, and other soil amendments and irrigation.

For. 55-320

Ind. Inputs and Returns in the Production of Various Crops in Northern Indiana. (1) Measure physical inputs and money costs involved in production of various farm crops under specified conditions; (2) learn yield expectations under given conditions on some of the more important soil associations; and (3) compute costs and returns for various crops and crop rotations under various conditions of soils, prices and treatments.
Agron., Agr. Econ. 894

Kans. Economic Application of Agronomic Production Data. (1) Develop information on marginal productivity of main plant food nutrients and marginal rate of substitution between nutrients for important crops and soil types; and (2) study production strategies designed to minimize risks attending unfavorable weather for otherwise optimum fertility plans.
Agr. Econ., Agron. 469

Mass. The Effect of Steam Sterilization of Massachusetts Greenhouse Soils. To determine effect of steam sterilization of greenhouse soils on soil nutrients, and on proper time limit for planting commercial floricultural crops after steam sterilization.
Flor. 64

Nebr. Soil Management Under Dry-Land and Irrigation Systems of Farming in Western and Central Nebraska. To determine (1) best soil management practices to use in irrigation farming to maintain high level of soil fertility and a high level of production; (2) irrigation which will give maximum efficiency of water use and a high level of production; and (3) best soil management practices to use in dry-land farming to use soil and water most effectively for crop production and maintain high soil fertility.
Agron. 418 Coop. ARS

Nebr. Engineering Phases of Land Treatment Related to Soil-Storage and Use-Efficiency of Rainfall. (1) Make a theoretical analysis of relationships between quantity and rate of rainfall and calculated evapotranspiration in relation to moisture accumulation and potential soil moisture levels under different cropping rates and sequences; (2) analyze engineering phases of land treatment to establish potential ways for improving soil moisture storage and use efficiency of rainfall; and (3) field test phases of land treatment which indicate potential improvement in soil moisture storage and use efficiency of rainfall.
Agr. Engin. 573

N. C.

Drainage, Site Preparation, and Site Improvement in Relation to Reforestation of Pocosin Lands. Learn (1) if furrows made by 2-disc Mathis fire plow will provide sufficient drainage on lands to prevent accumulation of surface waters when furrows are spaced to serve as site preparation measures prior to planting; (2) distance from main canals to which furrows provide sufficient drainage to be reflected in acceptable growth of seedlings into merchantable products, and learn cost of furrowing; (3) if location in furrow, on berm, or just outside berm, provides best site for setting out seedlings; (4) compare survival and growth performance of several appropriate species; and (5) by pot culture and in situ tests learn if additions of minerals, lime, N, and minor elements will increase seedling growth.

For. 138

Ohio

Responses of the Red Raspberry to Different Soil Management Practices, Training Systems, and Rates of Nitrogen Fertilization as Indicated by Growth, Yield and Mineral Nutrient Content of the Leaf. To determine (1) effect of different soil management practices, differential N fertilization, and training systems upon growth and yield response of red raspberry; (2) pattern of development of red raspberry fruit, and of individual druplet; and (3) effect of differential N applications on development of fruit and individual druplet.

Hort. 27

Ohio

Economics of Different Systems of Farm Management on the Old Lake Bed Soils of Northweatern Ohio. To determine (1) economics of different systems of farming that will maintain or increase soil productivity; (2) how far farmers can afford to go in adopting different soil conserving practices; and (3) if some farming units might not be submarginal if costs of fully maintaining land resources are changed.

Agr. Econ. 76-4 Coop. SCS, FES, ARS

Pa.

The Physical and Chemical Properties of Greenhouse Soil Mixtures. Learn (1) particular chemical and physical properties of greenhouse soil mixtures as a basis for soil preparation and fertilization; (2) effects of various soil amendments on the chemical and physical properties of greenhouse soil mixtures and on leaching of nutrients from these mistures; and (3) study the interaction of various soil amendments and cultural practices on yield and quality of floricultural crops.

Hort. 1313-A

P.R. Reclamation of Salty Lands in Puerto Rico. To determine (1) sodium content of salty lands of Puerto Rico; (2) salt tolerance of crops that may be grown in salty lands; and (3) practical means for reclamation of salty lands.

Soils 80

S.C. Drainage and Fertilizer Requirements of Forage Crops Grown on Coastal Plains Soils. To learn (1) relation of degree of drainage of certain soils to growth of various forage crops; and (2) fertilizer requirements of these crops on recently drained Coastal Plains soils.

Agron. 124

S. Dak. Soil and Crop Management Systems for Improved Soil Productivity. To (1) determine for different soil types and systems of farming of the subhumid area, the crop and soil management practices most capable of maintaining soil fertility; (2) determine tillage methods, including deep tillage techniques, and methods of handling crop residues that are most effective in conserving moisture, and maintaining and improving soil tilth; (3) develop soil management practices that will increase or maintain organic matter as well as improve physical nature of the soil, also studying effect of organic matter on soil structure; (4) compare effects of green manure as well as barn-yard manure to effects of soil amendments, soil conditioners, or deep tillage on soil structure, aeration and water permeability of claypan and Solonetzic soils; (5) evaluate changes in physical and chemical properties of soils, as influenced by cropping systems, residue treatments, soil conditioner, soil amendments, fertilizer treatment, and tillage; (6) cooperate with experiment stations of surrounding states and USDA by participating in conferences and exchanging any new information; and (7) cooperate with and contribute information on experimental results on organic matter and structure in connection with NC-17.

Agron. 4 **(NC-17)**

Wash. Determination of the Influence of Water Management and Amendments on Crop Growth and the Salinity and Alkali Status of Soils. To (1) evaluate or develop methods for rapid and inexpensive appraisal of needs of saline-alkali soils for amendments, and leachings; (2) determine influence of various systems of water management and use of soil amendments on salinity status of soils; and (3) evaluate efficiency of various methods of application of water and soil amendments in increasing germination and emergence of seedlings, in sustaining stands, and in promoting plant growth.

Agron. 1220 (W-29)

Wis. Soil Conservation and Fertility of Eastern Red Clay and Prairie Soils of Wisconsin. Learn most profitable and satisfactory use of lime and fertilizer and other management practices for crop production and soil conservation. Conduct management studies with various varieties of oats, barley, spring wheat, corn, alfalfa, bromegrass, sudan grass and soybeans.

Soils, Agron. Agr. Econ. 912 **Coop. ARS, SCS**

Wis. Soil Fertility and Management for Truck Crops in Southeastern Wisconsin. To learn most profitable and satisfactory use of plant nutrients and other management practices for production of onions, carrots, cabbage, red beets, beans, tomatoes and potatoes. Test soil management practices as use of trace elements, various methods of tillage, amendments, and crop residues to improve soil structure.

Plant Path., Soil, Ent. 1027

III. SOIL-PLANT RELATIONSHIPS

A. Field Crops

Ala. Identification and Evaluation of Some of the More Common Factors Limiting Cotton Yields in Alabama. Determine (1) effect of moisture on cotton yields, disease, insects, and morphological characters in cotton; (2) inter-relationship of N levels, insects, and disease on production; (3) relationship between cultural practices, soil physical properties, insect and disease control measures and vegetative growth and yield of cotton plant; and (4) average maximum yield obtainable without supplemental irrigation in various regions of state.

Agron., Soils 113 Coop. ARS

Ark. Studies of Physiological Factors That Influence the Nutritional Balance and Development of the Rice Plant. To (1) learn nutrient deficiency symptoms and correlate tissue analysis with these deficiency symptoms; (2) learn possible relationship between mineral balance and straighthead of rice; (3) study effects of soil alkalinity on nutritional balance of plant; and (4) learn effect of cultural practices as spacing, variety and water management on rice development.

Agron., Plant Path. 397 Coop. ARS

Fla. Curing Bright Leaf Tobacco Grown Under Different Levels of Nitrogen. Learn best procedures for curing tobacco during yellowing stage when grown under different levels of N.

Agron. Agr. Engin. 758

Pa. Agronomic Aspects of Improvement of Yield and Quality of Pennsylvania Tobacco. To (1) study rotations, fertilizer applications and other soil management practices to increase yields and quality of cigar filler tobacco; (2) determine specific factors and combination of factors which improve yields and quality of cigar filler tobacco; (3) investigate new materials to stimulate growth of tobacco plants in seed beds, and control suckers on the growing plants; and (4) study techniques of harvesting to improve quality and reduce losses of the crop.

Agron. 1244-A Coop. USDA

Tenn. Root Development of Farm Crops as Related to the Physical and Chemical Characteristics of the Soil. (1) Correlate root growth, rate of penetration and maximum depth attained with physical and chemical characteristics of soil profile; and (2) learn top-root ratios of a given crop on different soils.

Agron. 51 Coop. TVA

Va.

Fertilizer, Variety, and Sucker Management as They Affect the Quality and Yield of Burley Tobacco. To learn (1) effects of different rates of N fertilizers, three methods of sucker management, and two types of varieties upon yield, grade, nicotine and total alkaloid content of burley tobacco; (2) extent of interaction of rates of N fertilization, varieties and sucker management, as measured by yield, grade, and nicotine content of burley tobacco; and (3) residual influence of different rates of nitrogen fertilization of burley tobacco on yields of wheat and red clover.

Agron. 86069

Va.

Soil-Plant Nutrient Relationships in Peanut Production. To (1) determine the optimum calcium-potassium ratio in the fruiting area of peanuts for the production of peanuts; (2) estimate the quantity of calcium and potassium adsorbed and released by soil constituents similar to kaolinite, montmorillonite, and muck, which may actually influence formation of peanut fruits; (3) compare several liming materials and gypsum as sources of calcium for peanut fruits; (4) compare the ability of peanuts with that of oats to utilize the less available forms of nutrients in the soil; (5) evaluate by correlation methods the relationship of the various forms of plant nutrients in the soil to peanut production; (6) investigate the feasibility of indirect fertilization of peanuts; and (7) study the phosphorus and nitrogen needs of peanuts.

Agron. 86049 Coop. USDA

B. Forage and Range

Idaho

Development of a Fundamental Vegetation-Soils Classification of Non-Forested Ranges in Idaho as a Basis for Range Improvement. To (1) make basic study of vegetation and soils of non-forested range areas, to recognize and analyze different habitat-types of each major kind of range; (2) determine successional changes produced in vegetation and soils on habitat-types by separate or combined effects of heavy grazing, fire, insects, erosion, or other disturbing factors; and (3) evaluate potential productivity of various range habitat-types and thus provide sound basis for management and improvement practices adapted to specific areas.

Agr. Chem., Agron. 287 (W-25) Coop. ARS

Kans. Nutritive Value of Forages as Affected by Soil and Climatic Differences. To study (1) differences in nutritive value of forages as affected by variations in fertility and other characteristics of soils; and (2) effects of climatic factors.

Anim. Husb. 430

Mass. Mineral Composition of Forage Crops as Influenced by Soils and Soil Treatments. To (1) study effect of soil, cultural management and fertilizer practice on yield and mineral content of certain forage crops; and (2) determine possibilities of maintaining stand and high yields of such crops which have satisfactory mineral content thru management and fertilization.

Chem. 29

Nebr. Effects of Fertilization Practices on the Yield, Chemical and Botanical Composition, and the Feeding Value of Upland Prairie Hay in Southeastern Nebraska. To (1) determine effects of different fertilizer elements alone and in combinations on yield and chemical composition of upland prairie hay; and to study interactions between chemical characteristics of soils and effects of fertilizers; (2) study effect of fertilization practices on botanical composition of meadow vegetation, particularly on relative abundance of Kentucky bluegrass and cool-season sedges; and (3) determine effects of a few of the most promising fertilization practices on the feeding value of upland prairie hay.

Agron., Anim. Husb. 466

Texas Forage Production as Affected by Applied Nutrients. To study (1) effect of time, rate, ratio, source, and placement on efficiency of applied nutrients on: pure stands of grasses or legumes, mixed stands of grasses and legumes, native pasture mixtures; (2) effect of added nutrients on chemical quality, botanical composition, and feeding value of forage to animals; and (3) above points with or without supplemental irrigation in humid area of state and with irrigation in most arid area.

Agron., Soils 573 Coop. ARS

Utah Plant and Soil Relationships Determining Changes in Plant Cover on Desert Shrub Range Lands. To determine (1) why range plants occur in specific local areas and role of soil, water, salt, soil solution, aeration and livestock in plant distribution and invasion; (2) effect of soil on nutrient content of forage plants; (3) effect of forage removal on physiological responses of desert browse and grass species under various degrees of use during various periods of grazing season; and (4) effect of forage removal on nutritive content of desert browse and grass plants when used at various degrees and at various periods during grazing season.

Range Mgt. 411 (W-25) Coop. USDI

Vt. Soil as a Factor in the Economics of Forage Production. To (1) describe various patterns on Vermont dairy farms with different soil resources; and (2) analyze physical input-output relationships and cost and return from use of fertilizer and lime for various forage programs on the major soil association groups in Vermont.

Agr. Econ. 13 (NE-18) Coop. SCS

Wash. Development of a Fundamental Vegetation - Soils Classification for Arid Portions of Washington as a Basis for Range Improvement. To determine (1) habitat-types comprising major subdivisions of arid rangelands of central Washington where sagebrush and/or rabbitbrush create problems in forage production; (2) suitable vegetation-soil guides for identifying these habitat-types for use in range improvement and research; and (3) plant successions upon each habitat-type so that areas of comparable productivity can be recognized regardless of variations in types of plant cover now occupying them.

Bot., Agron. 1224 (W-25)

W. Va. Maintaining Profitable Stands of Alfalfa. To (1) evaluate soil conditions and disease and insect damage on established fields of alfalfa and relation to yield and longevity of stand; (2) determine effect of placement and amount of nutrient elements on establishment, yield, and longevity of alfalfa stands; and (3) determine effect of soil fungicides and insecticides on establishment, yields and longevity of alfalfa stands.

Agron., Plant Path. 50

W. Va. The Cause of and Remedy for Red Clover Failures in West Virginia. To (1) determine cause of failures of red clover hay and seed crops and devise remedies; and (2) investigate factors found primarily responsible for these crop failures.

Plant Path., Agron. 51 Coop. USDA

C. Vegetable and Fruit Crops

Ark. Studies of the Relationship Between Nutrient Supply, Plant Vigor, and Pruning in the Production of Grapes. Study effects of and interactions between levels of N, P and K and severity of pruning on plant vigor, fruit yields and quality of the Concord grape under conditions existing in Northwest Arkansas.

Hort., For. 441

Ga.

Quality and Nutritive Value of Cantaloupes as Affected by Levels of Nitrogen Fertilization and Irrigation. Learn effects of irrigation and level of N fertilization on chemical composition and edible quality of cantaloupes.
Home Econ., Hort. 80 (S-32)

Ky.

A Study of Blueberry Production on Moderately and Slightly Acid Soils. To determine, by various cultural practices, whether blueberries may be successfully grown on mineral soils of higher pH than is usually recommended.
Hort. 557

Maine

Nutrition of the Low-Bush Blueberry. To learn effect of native soil fertility, fertilizers, soil amendments, growth regulators, and certain management practices upon nutrition of low-bush blueberry in relation to vegetative response and fruitfulness.
Agron. 96

Mass.

The Mineral Nutrition of Vegetable Crops as Related to the Incidence and Severity of Certain Physiological Disorders. Learn effects of (1) concentrations of mineral elements, especially Ca, on incidence and severity of tipburn on lettuce grown in sand culture; (2) foliar applications of Ca on incidence and severity of tipburn on field grown lettuce; and (3) concentrations of mineral elements applied to the soil and/or foliage of vegetable plants where deficiencies might be suspected to be associated with physiological disorders.
Hort. 137

N.J.

Ion Relationships in Plants and Soils. Learn effects of Ca/K ratios on yields and composition of tomato fruit, factors affecting canning qualities of tomato fruit, and effects of clay mineral variations in soils as they influence the release of ions to tomato plants.
Soils 628

N. Y.
(Cornell)

A Study of the Soil Factors Associated with Significant Differences in Yield and Behavior of Important Fruit Crops. To determine the less obvious soil factors associated with significant differences in the yields of important fruit crops grown in the commercial fruit areas of the State.
Agr. Econ., Agron., Pomol., Bot., Plant Path. 137
Coop. USDA

Utah

Culture of Tomatoes and Lima Beans. To determine (1) best irrigation and fertilizer practices for tomatoes and lima beans; (2) influence of plant pruning on yield of tomatoes; (3) influence of sucrose sprays on survival of tomato transplants; and (4) effect of row spacing and planting time on yield of lima beans.

Hort., Agron. 384

Va.

The Effect of Method and Rate of Phosphorus and Complete Fertilizer Applications on the Yield, Quality, and Marketability of Tomatoes. Learn (1) most efficient time, method and rate of superphosphate application by yield, quality and P^{32} uptake of tomatoes; and (2) better method of applying complete fertilizer as measured by yield and quality.

Agron. Hort. 86087

D. Forests

Ala.

The Establishment, Growth and Yield of Forest Plantations. To determine effect of certain site factors, especially soil, on the establishment, growth and yield of commercial tree species already planted and to develop specifications and instructions for planting such species under the site conditions existing in the state.

For. 509

Mass.

Influence of Soil Conditions on the Growth of Forest Stands. I.- Red Pine. Evaluate the suitability and productivity of soil-sites for the growth of various tree species.

For. Wildlife 78 (NE-27)

Minn.

The Effect of Soil Properties on the Regeneration and Growth of Important Tree Species. To determine effect of various soil properties have upon natural regeneration and rate of growth of principal commercial species of trees in Minnesota, such as jack pine, white pine, Norway pine, and quaking aspen.

Soils, For. 2518   Coop. FS

Mo. The Effect of Soil and Parent Material on Distributions of Native Ozark Timber Species. To determine (1) relationship of loess distribution to occurrence of shortleaf pine and post oak; (2) relationship of geologic parent material to shortleaf pine distribution; (3) shortleaf pine as an early phase of old field succession on residual soils derived from granites and porphyries, and (4) geologic interpretation of Clarkesville Soil Series with reference to residuum and stratigraphy of the Roubidoux and Gasconade formations as they are related to forest types.
For. 260 Coop. FS

N. H. The Relationship of the Growth of White Pine in New Hampshire to Selected Environmental Characteristics. To determine variations in pattern of height and diameter growth of white pine as related to site, with particular reference to climatic, physiographic and biotic factors of the environment. Soil characteristics will be observed, measured and recorded for each plot.
For., Agron. 70

N. C. Relative Productivity of Lower Piedmont Forest Land for Pines or Hardwoods. (1) Learn site qualities essential for satisfactory growth and development of pines as against hardwood species in natural stands; (2) determine in plantations, separately and in combinations of mixtures, which species produce most acceptable growth on variety of sites found in lower Piedmont; and (3) fertilize and otherwise improve unsatisfactorily developing sites.
For. 139

Oreg. Forest Soil-Site Relationships. To (1) determine soil moisture and temperature relations on forest lands immediately after clear cutting and slash burning; (2) determine influence of plant succession on these soil moisture and temperature relations; (3) ascertain periods during plant succession when soil moisture and temperature conditions are most favorable for the establishment of tree seedlings; (4) learn the basic soil moisture characteristics of pumice soils; and (5) learn the trends of soil moisture and temperature conditions on pumice soils under different types of vegetative and surface cover conditions.
Soils 165

Oreg. Soil Factors Affecting the Survival and Establishment of Plantations in the Lower Foothill Areas on the West Side of the Willamette Valley. To learn (1) the soil factors important to survival of planted seedlings; (2) evaluate role of certain site factors in affecting soil moisture on planting sites; and (3) develop method of evaluating planting sites.
Soils 169-2

Tenn. Relationship of Soil and Other Site Factors to Forest Composition and Productivity. Relate soil type and other site factors, as aspect, topographic position and slope to: (1) dominant species of the site; and (2) growth rate and competitive position of principle tree species of the site.
For. (Ames Pl.) 107 Coop. TVA

W. Va. Studies of Soil Properties that Affect Establishment and Growth of Oak Stands in West Virginia. (1) Study effect of soil properties on site quality of oak stands and on their reproductive capacity; (2) test application of site-growth relationships found for oak species to other tree species on same soil mapping units; and (3) prepare detailed woodland site capability classification based on existing soil mapping units or on refinements of latter.
Agron. Genet. 117

E. Miscellaneous

Hawaii Cultural Practices with Tropical Crops. To (1) determine response in terms of yield, grazing capacity or other performance to various plant nutrient or other treatments; (2) determine response to varying interactions of edaphic and treatment factors; and (3) translate yield performance and effects of treatment interactions into forms usable in economic agriculture.
Agron. 122.1

Ill. Nutrition of Floricultural and Ornamental Crops. (1) Study the relations between varying soil nutrient levels, flower production and quality of carnations; and (2) soil nutrient requirements of floricultural pot plant crops.
Hort. 65-353

Ind. A Study of Root Absorption of Fertilizers by Plants. To learn relationships that exist between nutrient uptake from localized applications of fertilizers and the plant's environment.
Agron. Hort. 797

Mich. Influence of Crop Rotation, Plant Nutrient Supply and Tillage on Soil Conditions and Yield and Quality of Sugar Beets and Beans. (1) Study changes in soil conditions under various cropping systems; (2) evaluate cropping sequences in respect to maximum production of sugar beets and beans in respect to maximum economic return; (3) learn quality of beets and beans produced under different cropping systems; (4) influence of nutrient level on production and quality of sugar beets and beans; and (5) tillage methods as they affect stand and yield of beets and beans.
Soils Sci. 23

Mich. *The Effect of Soil Fertility on the Composition and Nutritive Value of Crops and on the Health, Milk Production, Reproduction and Nutritive Value of the Milk of Animals Eating the Crops.* To determine (1) if a high state of soil fertility results in an improved nutritive value as well as increased yield; (2) comparative effect of crops grown on depleted and improved soil on health, reproduction and milk production of offsprings for several generations; (3) effect of additions of lime, complete fertilizer and "minor" elements to a depleted soil on yield, composition, and vitamin content; and (4) effect of additions of lime, fertilizer and "minor" elements on chemical characteristics of a badly depleted soil.

Soils, Dairy, Chem., Home Econ. 76

Mich. *Soil Problems Encountered in Growing Plants in Greenhouses.* To (1-3 study) (1) symptoms of nutrient deficiency; (2) symptoms of nutrient and residue toxicity; (3) nutrient level requirements, (4-6 determine); (4) optimum pH for acid loving plants; (5) most desirable method of applying N, P, Mn and Fe fertilizers; and (6) importance of soil aeration in benches and pots and its effect on breakdown of organic materials.

Soils 77

Mich. *Relationship of Soil Nutrient Balance on Quality as Indicated by Composition of Crops Grown on Organic Soils.* To determine (1) varietal interaction on crops to plant nutrient requirements; (2) interaction of protein and amino acid content of crops to soil nutrient levels; (3) effect of soil nutrient levels on cation and anion constancy, and vitamin content of crops; and (4) relationship of soil tests to crop composition.

Soils Sci., Agr. Chem. 119

Minn. *The Establishment and Maintenance of Lawns in Minnesota.* To determine (1) best lawn grass mixtures for different soil types and degree of shade; (2) best means to start a new lawn using surface mulches;(3) amount and kind of topsoil needed over sandy subsoils to establish a permanent lawn; (4) best way to control crabgrass, chickweed, creeping charlie, etc.; (5) what types of soils should be aerated and best means of doing so; and (6) best fertilizer ratio, rate of application, and best times and methods of application.

Hort. 2121

Minn.

Evaluation of the Productivity of the Dominant Minnesota Soil Types as Related to Physical, Chemical and Morphological Properties and Management Practices. Establish statistically, reliable yield estimates for major agricultural crops on the dominant soil types as related to existing farm management practices.
Soils 2523 Coop. SCS

Mo.

Fertilizer Applications for Farm Crops. To study (1) effect of fertilizer materials on yield and composition of farm crops; (2) effect of plant nutrition additions on soil properties (not active 1954-55); and (3) use of mixed liquid fertilizers.
Soils 178

Mont.

The Effects of Milk Products When Used as Soil Amendments Upon the Soil and Upon the Development of Horticultural Crops. To determine specific physiological effects of milk products upon horticultural crops, soils, plant growth, yields and quality.
Hort. Chem. MS 820

N. C.

The Development of the Root System of Plants as Influenced by the Environment. To (1) characterize root systems of agriculturally important species and their varieties in order to determine certain aspects that may be used to differentiate their adaptation; (2) determine change in root distribution that may occur due to differences in soil properties and management practices; and (3) determine effect of any interaction that may occur within various pure and mixed plant populations.
Soils, Agron. 120

Ohio

Relation of Soil Temperature to Growth and Mineral Absorption by Plants. To (1) study relation of soil temperature to soil fertility, and mineral absorption and growth of plants; (2) determine significance of soil temperatures as factor in growth of plants; and (3) study effect of soil temperature on dynamic chemical properties of soil and mineral nutrition of plants to determine how soil temperatures influence growth of plants.
Agron. 58

Ohio

Survey of Soil and Crop Potentialities and Causes of Variability on the State Muck Crops Research Farm. (1) Uniformly crop total farm area with 4 vegetable crops as indicators of soil cropping potentialities, soil variability and soil nutrient supply, including trace elements; (2) make foliar analysis for soluble fractions and total quantities of eleven nutrient elements; analyze at all stages of growth; (3) measure plant growth and stand at 2 periods up to harvest; and (4) measure yield and grade at harvest by count and weight.
Hort. 131-2

Ohio Soil and Plant Survey at the Muck Crops Substation to Determine the Causes for Irregularities in Plant Growth. Analyze soil samples from Muck Crops Substation for nutrient elements, pH, etc., to obtain information useful in elucidating the cause of unproductive areas, including adverse affect of soil-borne organisms.
Agron. 131-3

Pa. Influence of Soils and Fertilizers on the Composition and Nutritive Values of Foods and Feeds. To study influence of nutritive conditions of plant growth on composition and nutritive values of agricultural products.
Agron., Dairy, Anim. Nutr., Hort. 1019

Pa. The Influence of Various Fertilization Practices on Crop Yields and Crop Quality in Rotations. To determine most desirable fertilization practices for obtaining maximum yields and quality of each crop in a corn, small grain, and hay rotation consistent with efficiency production.
Agron. 1100

S. C. Relationship Between Potassium, Sodium, Calcium, Magnesium and Some of the Minor Plant Nutrients in the Growth of Cotton, Oats, Lespedeza, and Certain Other Crops Grown on Various Soil Types. To determine (1) reciprocal relationship between K, Ca, Na, Mg and other nutrients in growth response of crops at varying pH levels; (2) reciprocal relationship between application of these elements and chemical analysis of plant materials from same plots; (3) minor element response on selected soil types; and (4) some soil and crop conditions under which greatest response from these elements are obtained.
Agron. 122

S. Dak. Nitrate Poisoning. To (1) study accumulation of nitrates in oats, corn and other plants and determine factor(s) responsible; (2) determine if there is a relation between NO_3 poisoning and other forage poisonings, particularly cornstalk poisoning; (3) determine effect of 2,4-D and other herbicides on uptake and metabolism of NO_3 and other forms of N by plants; (4) investigate livestock water supplies for NO_3 content; (5) determine minimum NO_3 content of water sufficient to induce methemoglobinemia in ruminant animals in absence and presence of feeds containing nitrate N; and (6) determine control and preventive measures and develop additional antidotes for NO_3 poisoning.
Biochem., Vet. 87-R

Tenn.

The Effects of Certain Atmospheric Effluents Upon the Growth and Composition of Plants, and Upon Animal Life, at Locales in East and Central Tennessee. To ascertain the verity of numerous contentions that the harmful effect upon growth and composition of crops and the severe effects upon livestock in certain locales are attributable to effluents released from nearby manufacturing operations; to establish the causal factors for any such determined effects; and to propose remedial measures and to demonstrate their efficacy.

Agron. 50 Coop. TVA

Texas

Relationship of Variations in Climatic and Soil Moisture Factors to Yields and Their Effect on Dryland Farming and Ranching Decision-Making in High and Rolling Plains Area of Texas. (1) Learn relationships between variations in various climatic and soil moisture factors and yields of crops and forage in High and Rolling Plains area of Texas for different soil types and under different soil management; (2) from above relationships, develop prediction equations for yields based on certain climatic and soil moisture factors known at a given time of year, and other factors; (3) in terms of above, define drouth and attempt to obtain probability of occurrence of drouths of various lengths and intensities; (4) learn how variations in yields influence farmers and ranchers in area; and (5) develop precautions for uncertainty based on knowledge obtained from above.

Agr. Econ., Sociol., Agron., For. 1022 Coop. ARS

Texas

The Influence of Mineral Nutrition, Irrigation and Variety on the Nutrient Uptake and Metabolism of Cool and Warm Season Vegetable Crops. Learn (1) effect of various levels of macro and micro nutrients on metabolism of plants with emphasis on uptake and utilization of S and Mg; (2) interaction between irrigation and mineral nutrition on cool and warm season crops; and (3) differential variety response to macro and micro elements with and without supplemental irrigation.

Hort., Agron. 1044

Texas

The Mineral Nutritional Aspects of Conditioning Development and Quality of Crop Plants on the Texas High Plains. (1) Study effect of form of N, and various trace metals on uptake of P ; (2) measure response to high and low N/P balances at optimum and low temperatures; and (3) provide chemical data on actual uptake of nutrients in fertilizer trials.

Plant Physiol., Path. 1134

REGIONAL PROJECTS

NC-16 Mineral Deficiencies in Soils. (1) To develop and improve methods for estimating and evaluating nutrient deficiencies in soils, and to coordinate their use among the states of the region; and (2) to evaluate the comparative efficiency of certain fertilizers and fertilizer application practices, and to investigate the causes of differences in efficiency under various crop, soil, and climatic conditions of the region.

Cooperating stations: Section a, I-B: Ind. This section, I-B: Mo., Nebr., N. Dak., Ohio and Wis.; I-C: Iowa and Nebr.; I-D: Ill., Iowa, Kans., Mich. and Minn. II-C: Nebr.

NC-17 Value of Organic Matter and Soil and Crop Management Practices in Improving Soil Structure and Productivity. (1) The evaluation of physical conditions of soil that are favorable to the yield of crops; and (2) the evaluation of the chemical composition and reactions of organic matter that affect structure and productivity.

Cooperating stations: Section a, I-B: Ill.; II-D: Ind. This section, II-C: Nebr.; II-F: S. Dak. Section c, I-E: Iowa, Kans., Mich., Minn., Ohio, S. Dak. and Wis.

NE-11 Soil Structure Problems in Northeastern Agriculture. (1) To devise and evaluate practical means of identifying, creating and maintaining desirable physical conditions for crop production in Northeastern soils; and (2) to determine in what ways soil structure influences the growth and nutrition of plants.

Cooperating stations: Section a, II-D: Del. This section, II-B: N.H. Section c, I-E: Conn. (State), Conn. (Storrs), Maine, Md., N.H., N.J., N.Y. (Cornell), Pa., R.I. and W.Va.; III-B: Conn.

S-14 The Influence of Chemical, Physical and Mineralogical Properties of Soils on Their Structure and on Plant Growth. (1) To devise means of separating the crystalline and amorphous components of selected representative southern soils; (2) identify and determine quantitatively the various crystalline and amorphous components, including total organic matter; (3) to characterize these constituents through a determination of their chemical, physical and mineralogical properties; (4) to compare the reactions of these components in natural and in artificially prepared mixtures; and (5) to relate these soil properties to soil structure and to plant growth.

Cooperating stations: Section a, I-C: Ark., Fla., Miss., Tenn. and Texas. This section, I-E: Ky. Section c, I-E: P.R. and Texas; III-A: La.; III-B: Ga., N.C., Okla. and Va.

W-31 The Conservation and Improved Use of Nitrogen in Western Soils. (1) To evaluate the factors affecting nitrogen transformations in soils including losses, gains, immobilization, mineralization, and mineral fixation and to devise practices for the control of these transformations; and (2) to determine the effects of different nitrogen fertilizers on soil properties.

Cooperating stations: Section a, II-A: Ariz., Calif. and Oreg. This section, I-B: Colo., Hawaii, New Mex., Utah, Wash. and Wyo.

For regional projects in related areas see:

NE-18 Economics of Forage Production and Utilization, in part 2, section b.

NE-24 The Nutritive Evaluation of Forages, in part 4, section a.

NE-27 Forest Tree Improvement and Site Capability Determinations, in part 11.

NE-29 Establishment and Management of Perennial Forage Species and Varieties, in part 10.

S-12 Production and Evaluation of Forage Crops and Pastures in the South, in part 10.

S-32 Quality and Nutritive Value of Vegetables as Influenced by Cultural Conditions and Post - Harvest Practices, in part 13, section d.

W-25 Ecology and Improvement of Brush Infested Range Lands, in part 10.

W-29 Soil-Water-Plant Relationships Under Irrigation, in part 21, section c.

W-32 Basic Hydrologic Factors in Precipitation Disposal Related to Water Conservation, in part 3, section a.

LIST OF COMPILATIONS OF FEDERAL-GRANT RESEARCH PROJECTS AT STATE AGRICULTURAL EXPERIMENT STATIONS

ARS-23-8: Part Numbers	Subject-Matter Area	Title of Section
1	Agricultural Chemistry	Agricultural Chemistry
2	Agricultural Economics	a. Prices, Incomes, & General Studies of Commodities & Industries b. Farm Management c. Land Economics d. Farm Finance & Taxation
3	Agricultural Engineering	a. Land & Water Use & Development b. Power Machinery & Equipment c. Farm Structures & Materials
4	Animal Husbandry	a. Beef Cattle b. Sheep & Goats c. Swine
5	Dairy Husbandry	Dairy Cattle
6	Dairy Technology	Dairy Technology
7	Entomology & Economic Zoology	a. Field Crop Insects b. Fruit, Nut & Vegetable Insects c. Miscellaneous Insects & Economic Zoology d. Insecticides
8	Field Crops	a. Cereal Crops b. Oil, Fiber, Tobacco & Sugar Crops
9	Food Science & Technology	a. Food Chemistry, Microbiology, Sanitation & Public Health b. Food Engineering, Processing, Product and Process Development, Utilization and Waste Disposal c. Food Quality & Standards, Acceptance, Preference, & Marketing
10	Forage Crops, Pastures & Ranges	Forage Crops, Pastures & Ranges
11	Forestry	Forestry

ARS-23-8: Part Numbers	Subject-Matter Area	Title of Section
12	Fruits & Nuts	Fruits & Nuts
13	Home Economics	a. Human Nutrition
		b. Housing
		c. Clothing & Textiles
		d. Foods-Consumer Quality & Utilization
		e. Household Economics & Management
14	Economics of Marketing	a. Field Crops
		b. Fruits & Vegetables
		c. Livestock, Meats & Wool
		d. Dairy Products
		e. Poultry & Poultry Products
		f. Forest Products & Ornamental & Drug Plants
		g. Cross-Commodity & Functional Studies
15	Meteorology	Meteorology
16	Ornamental & Drug Plants	Ornamental & Drug Plants
17	Plant Pathology & Bacteriology	a. Plant Pathology, Botany, & Diseases of Miscellaneous Crops
		b. Diseases of Field Crops
		c. Diseases of Fruit Crops
		d. Diseases of Vegetable Crops
18	Plant Physiology & Nutrition	Plant Physiology & Nutrition
19	Poultry Industry	Poultry Industry
20	Rural Sociology	Rural Life Studies
21	Soils	a. Soil Chemistry & Microbiology
		b. Soil Fertility, Management & Soil-Plant Relationships
		c. Soil Physical Properties, Conservation & Classification
22	Vegetables	a. Vegetable Crops
		b. Potatoes
23	Veterinary Science	Veterinary Science
24	Weeds	Weed Control